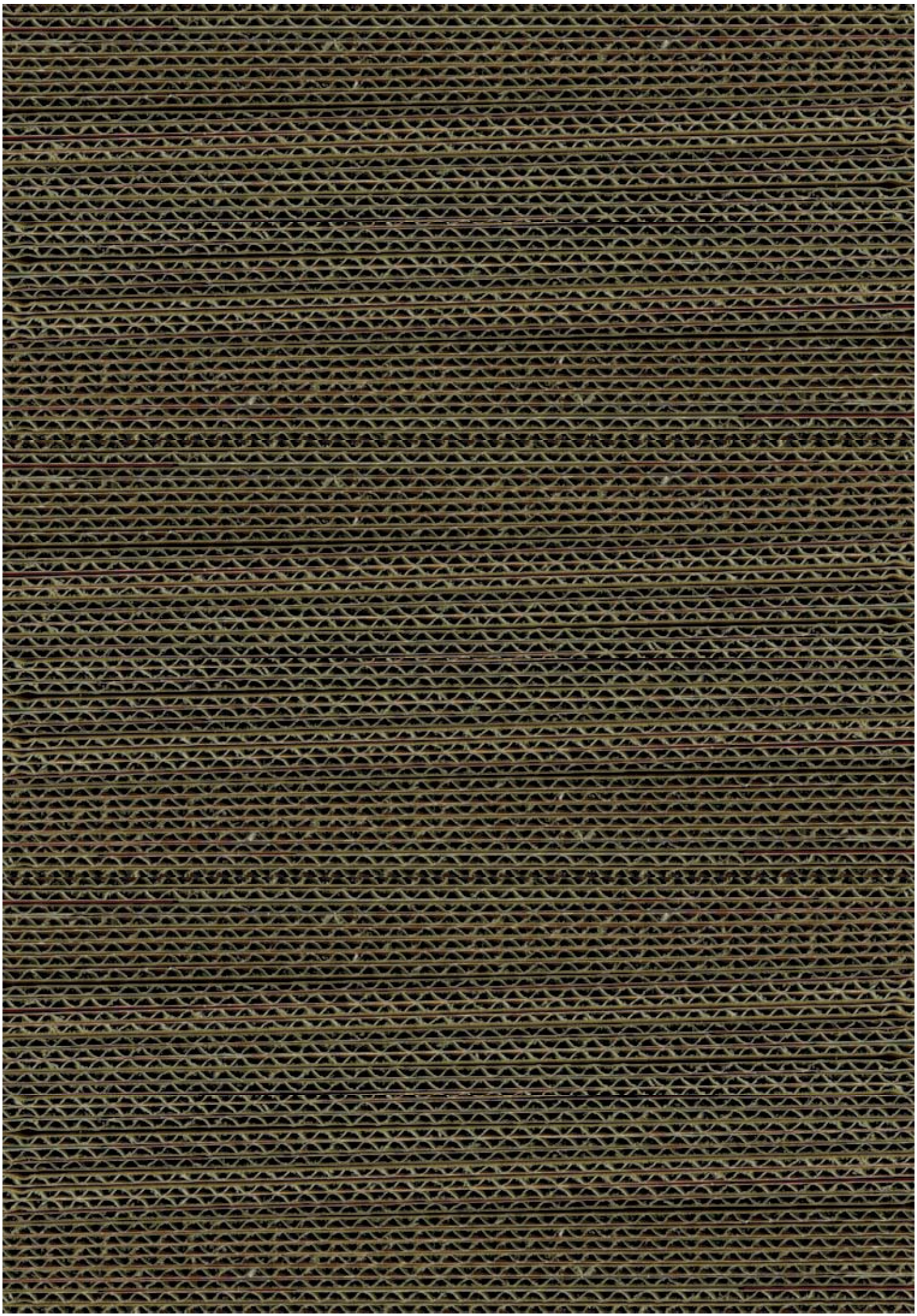

MISSING LINKS

Evolutionary theory as a model and scientific intervention
as a strategy for artistic process and production

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Technical Officer Neale Kenny

Stephen Dixon
Oskar, Lillah and Stella Summers Dixon

D E C L A R A T I O N

I certify that except where due acknowledgement has been made, the work is of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

Fleur Summers

MISSING LINKS

ADMINISTRATION

RESEARCH PROPOSAL

PROJECT TITLE
Missing Links - Evolutionary theory as a model and scientific intervention as a strategy for artistic process and production

PROJECT SUMMARY

This project will investigate of the effects of applying scientific modes of analysis to the process of artistic production. Methodologies derived from the disciplines of classification and taxonomy will be used to examine the formal relationships between sculptural objects in respect to their conceptual and actual development. Evolutionary theory will be used as a model in this analysis. The project will investigate the complexity of the system and explore the effect of the intervention of scientific methods on artistic production.

SUPERVISORS AND CONSULTANTS
Senior Supervisor: Peter Cripps, Sculpture, School of Art, RMIT.
Supervisor: Suzie Attiwill, Interior Design, School of Architecture & Design, RMIT

THE RESEARCH PROGRAM

Brief Description

Background:

Science and art are often posed as binary opposites or as bifurcated practices. Science is perceived as 'hard', analytical and systematic and art as 'soft', subjective and subject to chance. However, the strategic approaches of science and art have much in common. Both involve cycles of analysis and synthesis. Both involve techniques of observation, are creative and use abstract models to understand the world.

Abstract symbols and synthetic systems are common strategies in the production of scientific knowledge about natural phenomena. In particular fields, scientists are reliant on developing knowledge of the area by creating conceptual projections of invisible structures. This generally involves the development of specifically designed tools. For example, microbiology is a field which is defined by structures which can't be seen by the naked eye. The world of the microscopic is reconstituted through the microscope which, along with a range of biochemical tests, allows the scientist to detect and describe certain organisms. However, these interpretive tools and concepts are embedded within the discipline. Only the organisms detectable through the filter of the microscope are defined as part of the field. This system of seeing things determines what is seen and how this knowledge is produced. It both constrains and enables knowledge within the discipline.

Both artists and scientists participate in this construction of self-contained worlds in order to analyse the experiential. A number of artists have constructed models and representations derived from social and natural phenomena. Examples include the reconstructions of Emilia and Ilya Kabakov, Peter Hill's *Museum of Contemporary Ideas*, the Boyle Family's casts of the earth's surface and Anne and Patrick Poirier's scale models of fictional ruined cities. This type of artistic practice is closely aligned with systematic academic and scientific approaches to collection, analysis and synthesis. Disciplines such as the practices of archaeology and palaeontology depend on collections of pre-existing objects which are then used in the development of systems of knowledge. It is the conceptual framing of these objects through the influence of assumptions and values at a particular time which acts as the contextualising force.

Artists also engage with pre-existing or found objects and have worked with recontextualisations of existing collections within museums in particular. However, another common strategy involves the multiple where the series of objects which constitutes the collection is made by the artist. Examples include Alan Mc Collum's *Lost Objects* (1991), Eugene Carchesio's matchbox construction and Sol LeWitt's series of incomplete open cubes. A single work can be made up of a large number of individual objects which are constituted through their relationships to other pieces and the group as a whole. This project will employ this strategy of the multiple to produce a series of objects to be contextualised through a scientific intervention.

In biology, one of the most fundamental contextualisations of historical and natural objects was proposed by Charles Darwin's *Theory of Evolution by Natural Selection*. This theory was developed through the investigation of relationships between individual living and fossilised specimens. Darwin was primarily interested in the temporal processes of differentiation and divergence within species. While it is scientifically widely accepted, Darwin's theories are based on incomplete fossil records with knowledge increasing through the use of technologies such as DNA testing, carbon dating and isotopic clocks. Ultimately, the theory of evolution will remain unvalidated as the original conditions in which existing species developed no longer exist. This inherent subjectivity reminds us that the system is built upon a massive theoretical structure which, in part, substitutes the production of imagined phylogenies or histories for empirical evidence.

This project proposes to bring together the notions of the collection, its contextualisation and the construction of a self-created system to produce knowledge in a study of artistic process and production. A series of objects, which are materially and conceptually self-defining as a group, will be constructed using biological forms as inspiration. Evolutionary theory and the practices of classification and taxonomy will be used in the development of techniques specific to the study of these objects and this project in order to examine processes of differentiation and divergence. Through this process, a system will be synthesised which is specific to these objects and which, alongside specifically designed methods and tools, will define the field of the study. The outcome of these experiments will be a series of installations which explore the effects of scientific intervention on artistic process and production.

Aims and Objectives:

The objective of this research project is to undertake a scientific analysis of the products of artistic process in order to explore the convergence of art and science in my own practice. By using general scientific observational techniques to gather evidence and by applying evolutionary theory as a model, I aim to explore and elucidate connections between formal relationships in relation to the conceptual and actual development of my own artistically produced objects. This comparison of artistic and scientific modes of thinking and researching will result in a series of installation based works.

Research Questions:

In what ways can a series of artist made objects retain information pertaining to the construction process? Can a history of the process be elucidated through an objective, formal analysis using scientific methods?

In what ways can scientific theories of evolution and the discipline of taxonomy be applied to to the analysis of the production of a series of art objects?

In what ways can artistic production and presentation be altered through the intervention of scientific method? Can a hybrid field of knowledge be produced through this process?

Rationale for program

Evolution is an essentially creative process producing an outstanding array of biological material. As a gradual, unfolding, ongoing process of development, it offers a rich model of production and analysis for both scientists and artists. In the laboratory, it has been explored using computer models of artificial life forms which can interact and evolve. Researchers set certain parameters or rules to control the growth and life cycles of the synthetic organisms, based on real or imaginary populations. In both cases, they allow the potential of the evolutionary process to reveal itself under controlled conditions.

Projects such as these which require specific technologies and knowledge have resulted in artists entering laboratories and working alongside scientists. This has resulted in an interesting blurring of the boundaries between the practices of scientists and artists with some scientists coming to identify as artists. For example, Thomas Ray who is a Professor in Zoology, identifies as an artist through his work with the evolution of computer generated artificial life forms. This project, however, proposes to reverse this, using the artist's studio as a site to investigate a physical process of evolution through material objects. It invites the interaction of scientific methodologies with artistic production attempting to create works which embed these methods within artistic outcomes

My practice as an artist has been influenced by my previous work experience as a microbiologist. This research project draws on my past theoretical and technical knowledge and ongoing interest in biology and related technologies. While I will operate primarily as an artist throughout the study, I propose to bring my scientific experience into the studio in the form of an intervention on my artistic process. The artistic work produced in this study will be defined through its operation as a scientific research object within the studio as laboratory. Artistic process will be subject to scientific scrutiny and artist-made objects, constructed specifically for the project, will become specimens for the research. These objects will operate as provisional forms or models of the conceptual, artistic thought process which have been translated into material forms in order to be tested. Specific tests will be developed to analyse the morphological or formal properties of these specimens and then this information will be integrated with documentation of the artistic process. The result of this hybridisation of scientific and artistic methods may incorporate the original objects, the documentation and testing devices as well as new structures which may be developed in response to this material.

This project proposes to not merely apply science to art but to use art to critique, extend and develop particular systematic, scientific methodologies. It proposes a scenario in which a version of the theory of evolution can be tested on actual objects produced by artistic production. Patterns of growth and selection pressures can be explored through this artistic process. This activity will result in the development of new analytical systems to be used in the investigation of art objects and practice. The possible applications of these systems could be extended to generate and investigate further bodies of work outside of the current project.

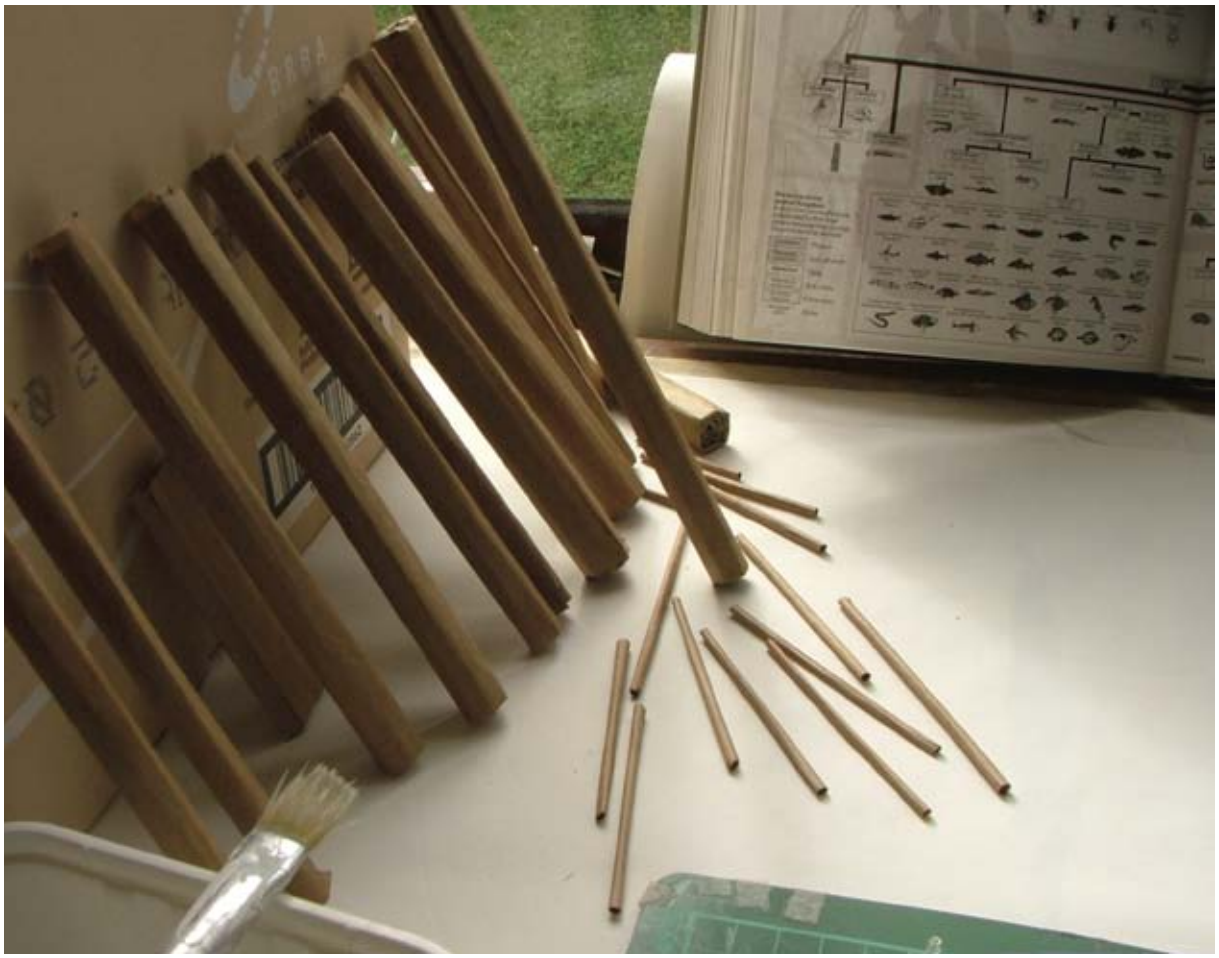
RESEARCH METHODOLOGY

Stage 1 - PREHISTORY

A series of objects were constructed in order to undertake material research and small-scale experimental development. This process was visually documented and a small number of drawings produced. These images existed before the development of methodologies for written documentation and as such form the project's prehistory.

Stage 2 – TEST SERIES

A series of objects were developed over the period of a week. Each day, one object was constructed within the time span of one hour. A short written text was produced each day as part of the Test Series Object Log. The aim of this series was to develop a set of procedures for construction, development and documentation to be applied to the research series.



Stage 3 – RESEARCH SERIES

This stage involved the construction and documentation of 50 objects. A detailed diary of construction including photographic documentation accompanies each item. This diary, titled the Research Series Object Log, includes descriptions of each object as well as thoughts, feelings and ideas regarding the process of the project. The process of the accumulation of objects can be viewed as an animated sequence on the *Missing Links – Stratification* DVD.

Stage 4 – MORPHOLOGICAL ANALYSIS

Each object in the research series underwent rigorous formal and structural examination using a standardized research procedure. These details were recorded using Morphological Analysis forms specifically designed for use in the project. This process of data collection was visually documented and can be viewed, in part, in real time on the *Missing Links – Morphological Analysis Workshop* DVD.

Stage 5 – DATA COLLATION

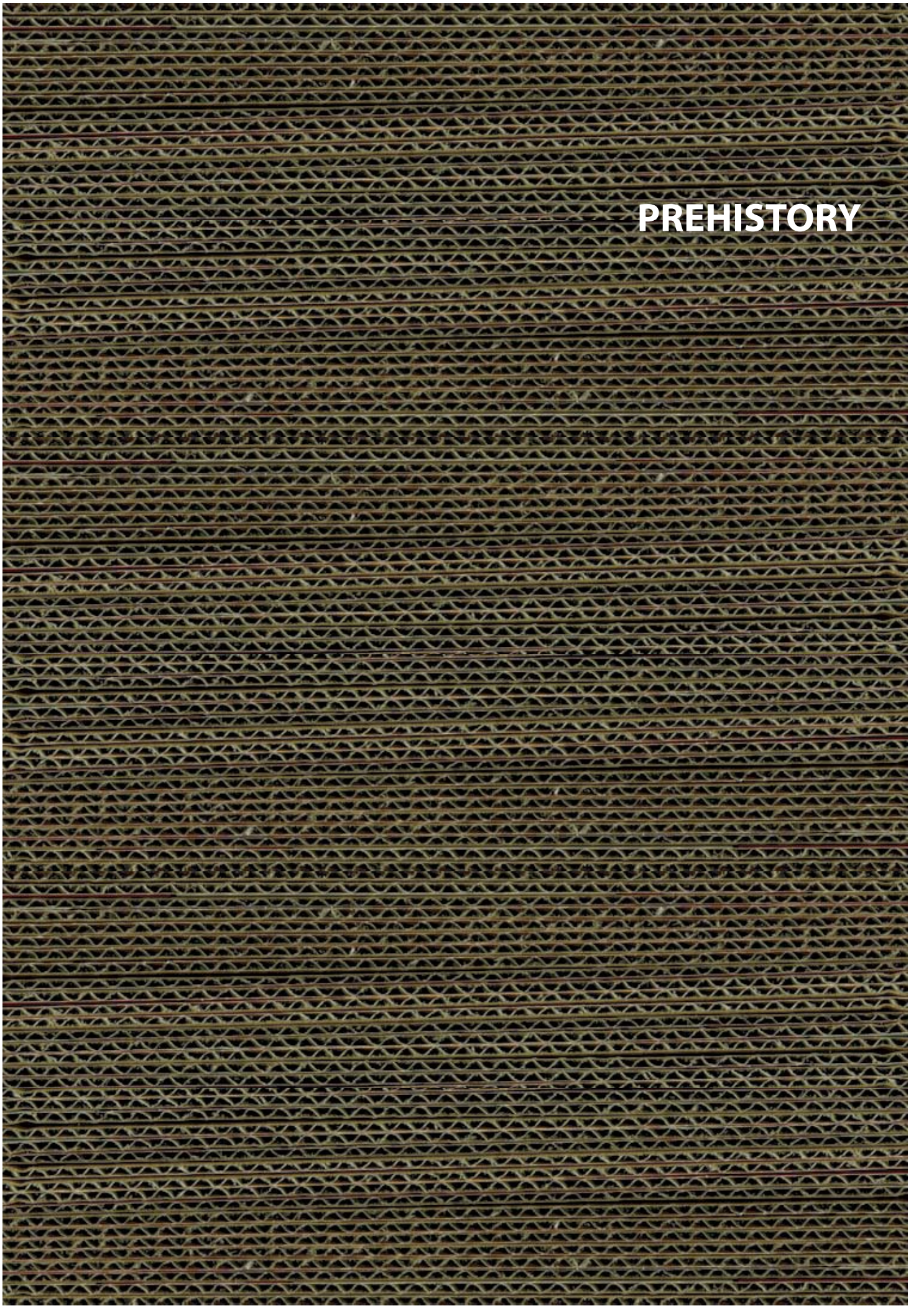
A series of tables and figures were constructed in order to collate the information collected.

Stage 6 – DICHOTOMOUS KEYS

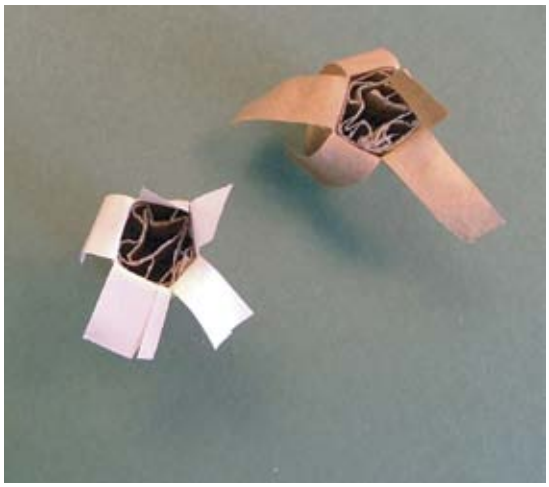
A series of dichotomous keys were constructed to use in the identification of the main research objects. The complete key for all 50 objects can be viewed as a scrolling text on the *Missing Links – Dichotomous Key* DVD.

Stage 7 – EVOLUTIONARY RELATIONSHIPS

The project culminates in the exploration of evolutionary relationships within the project. Both the test series objects and the research series objects were used to theorise developmental and generative relationships. A series of possible evolutionary sequences was explored using data collated and expressed as a series of evolutionary trees. One of these trees was translated into an animated sequence using photographic stills and can be viewed on the *Missing Links – Endless Form* DVD.



PREHISTORY



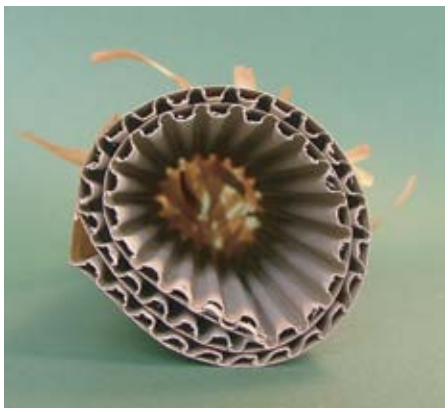














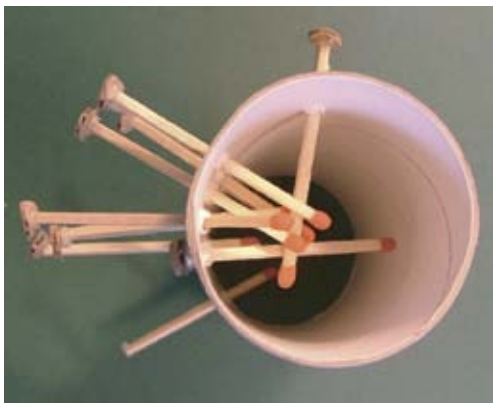


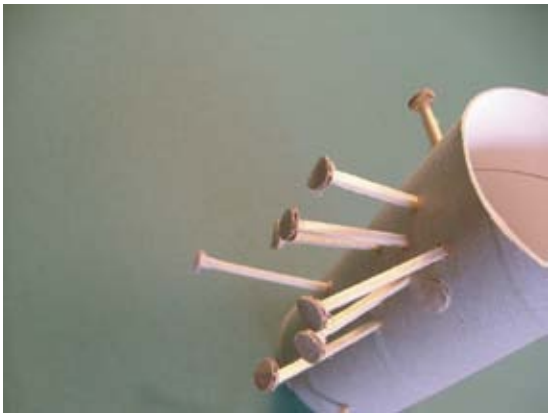


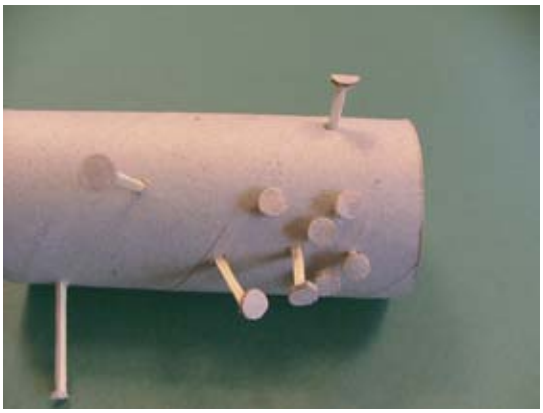


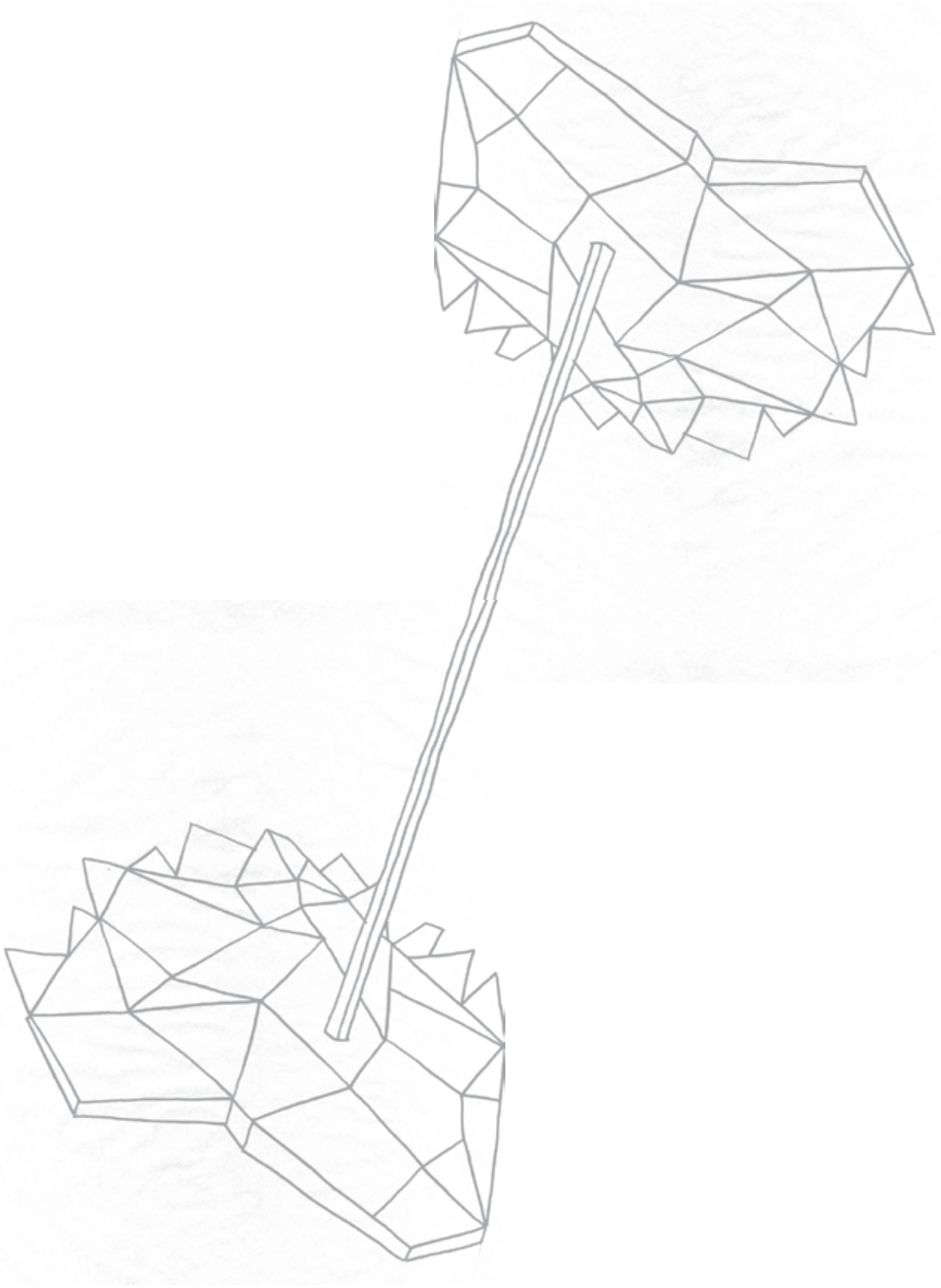


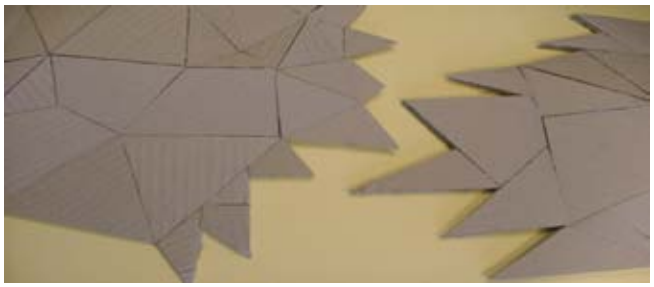


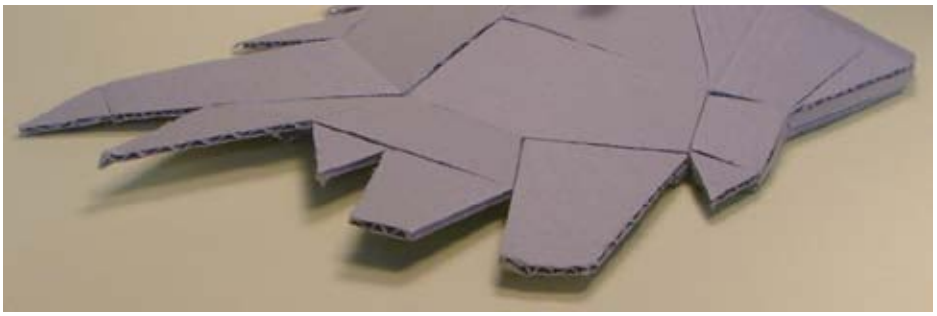



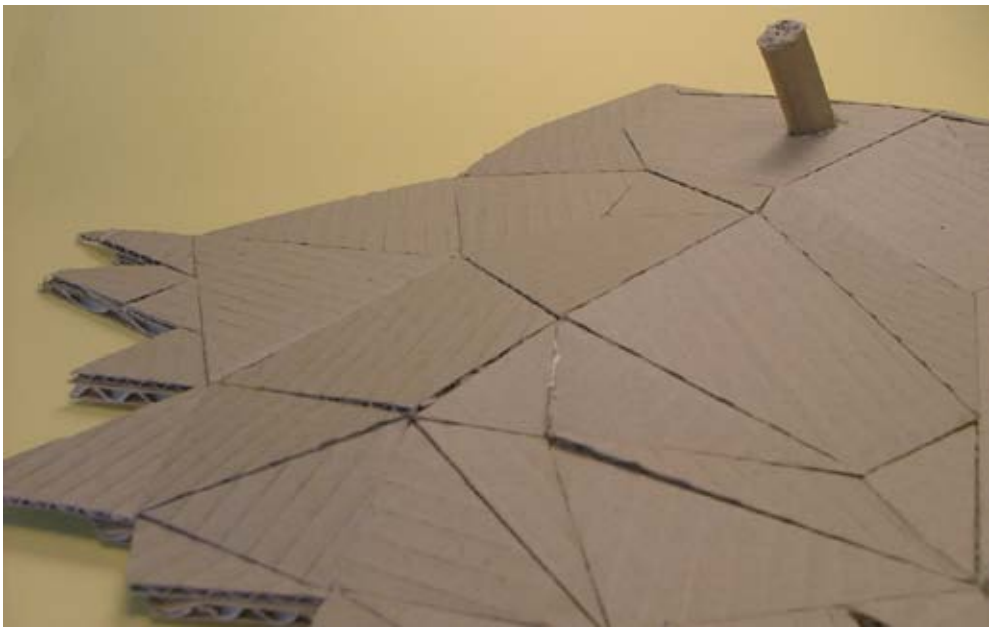


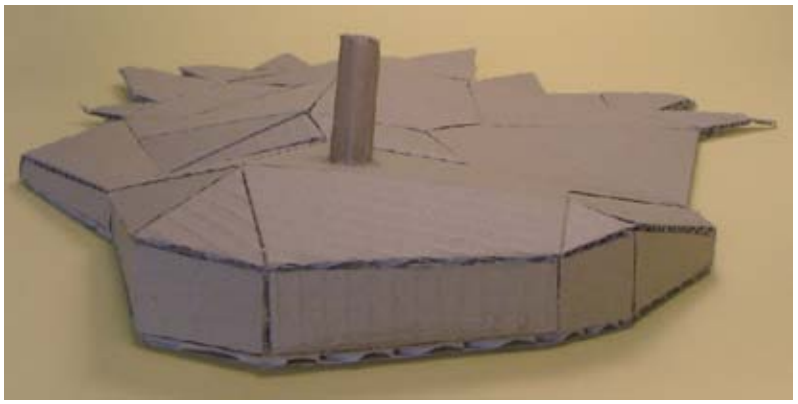


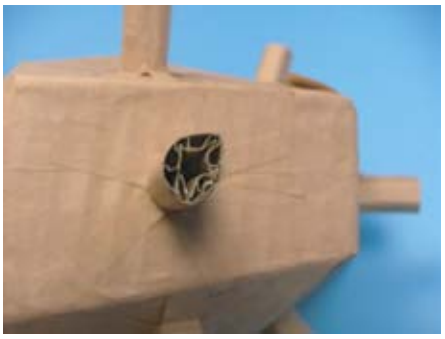


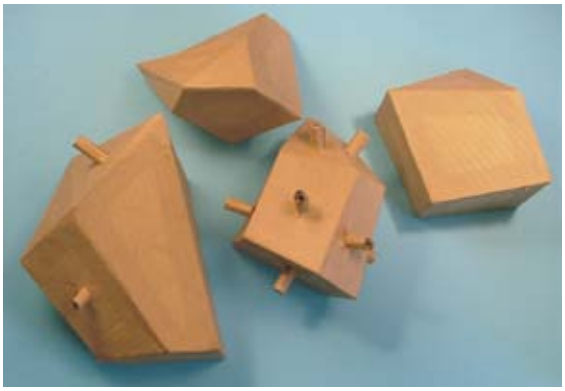


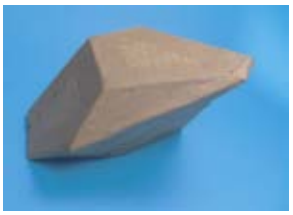


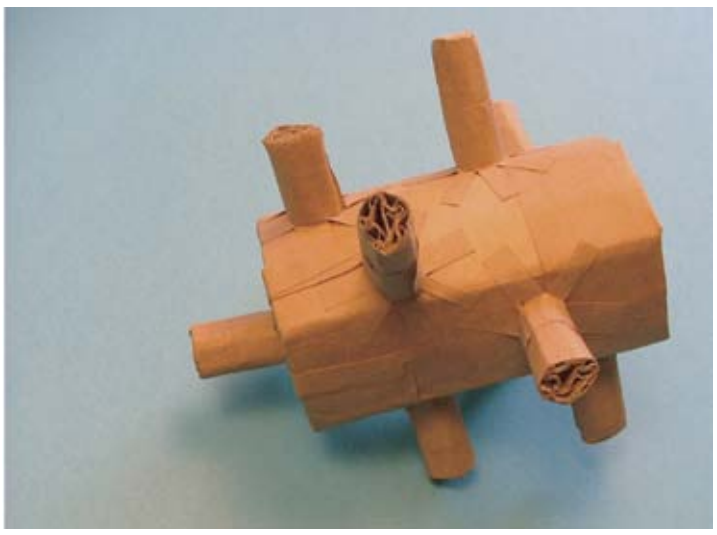


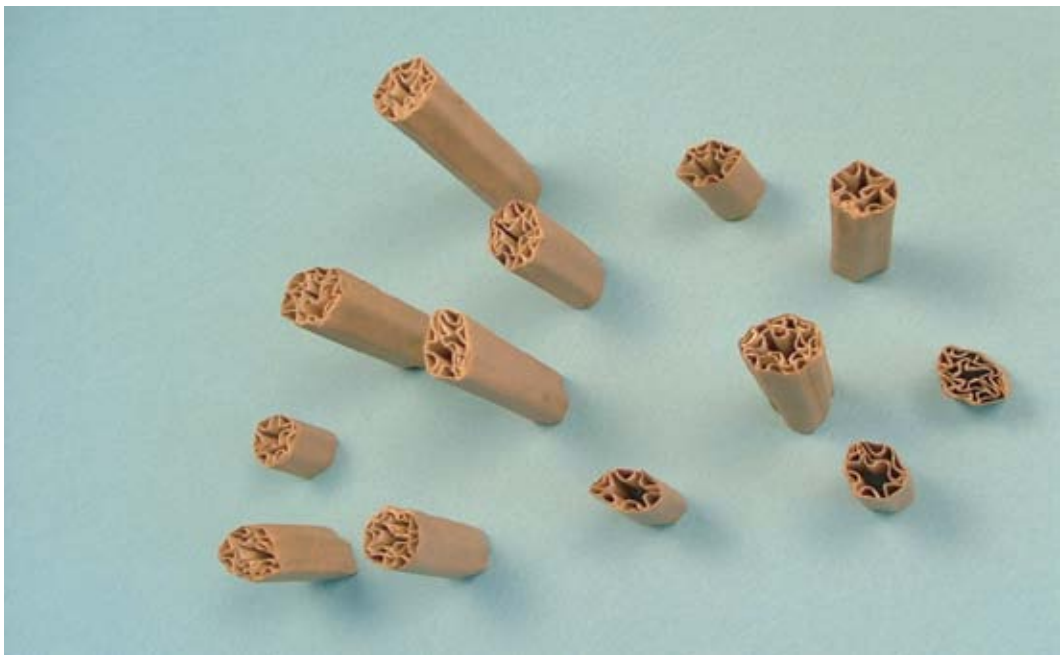


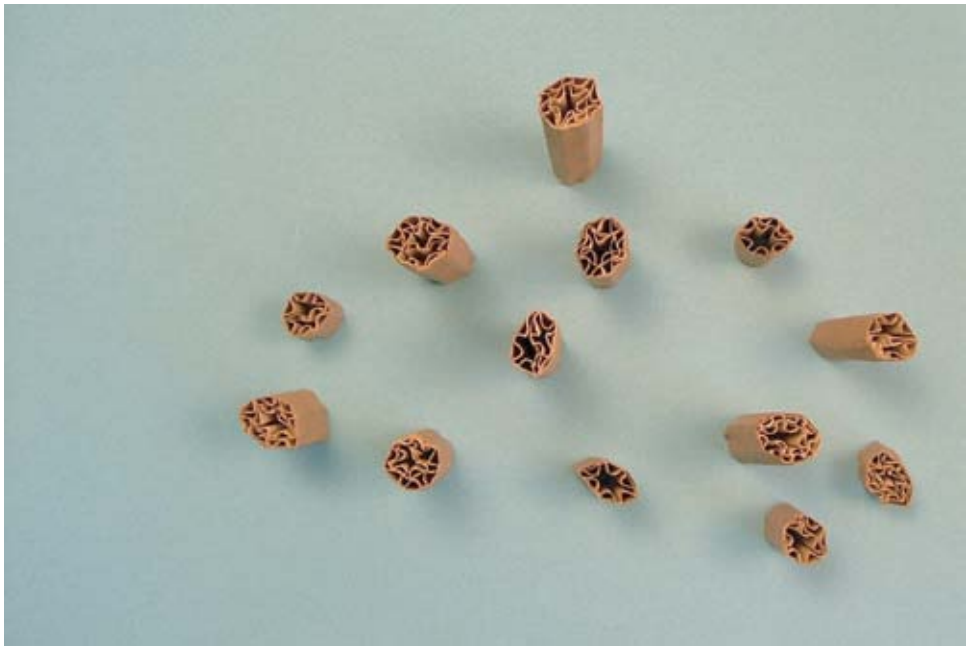


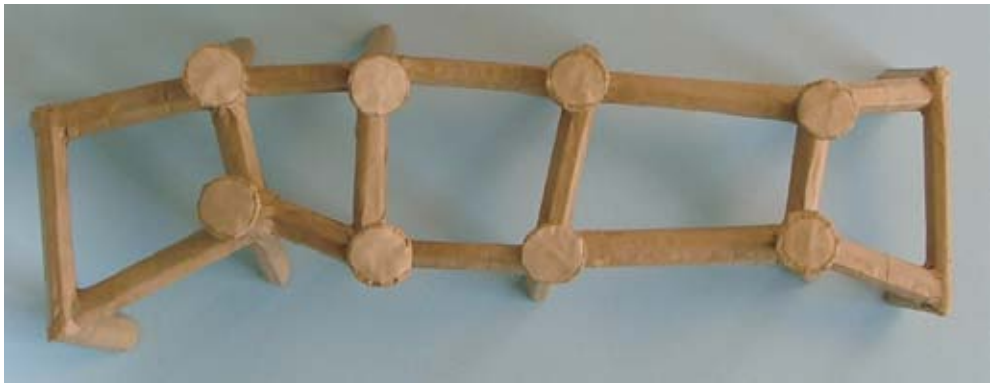










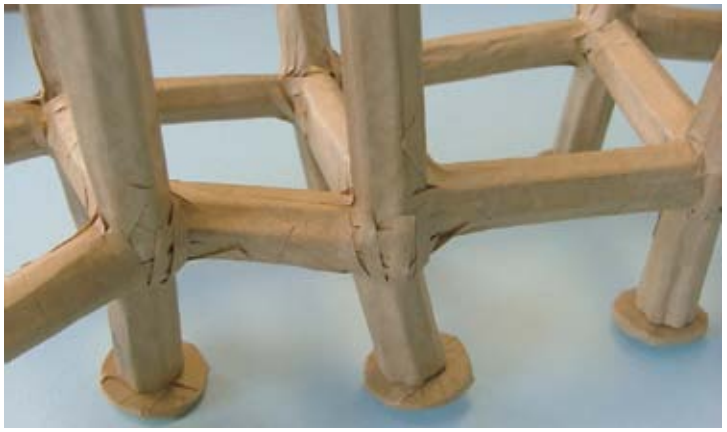


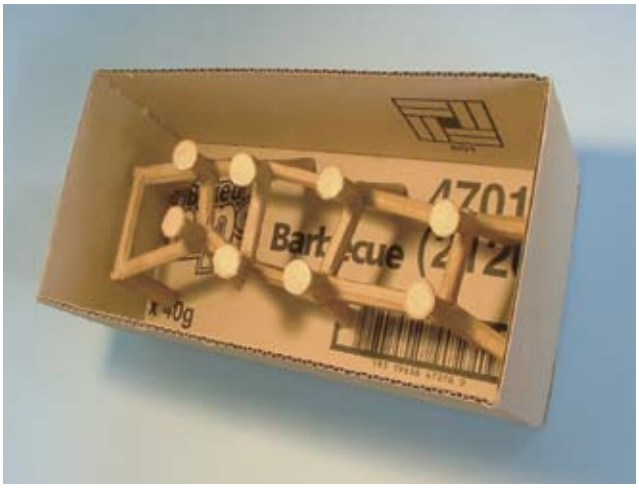


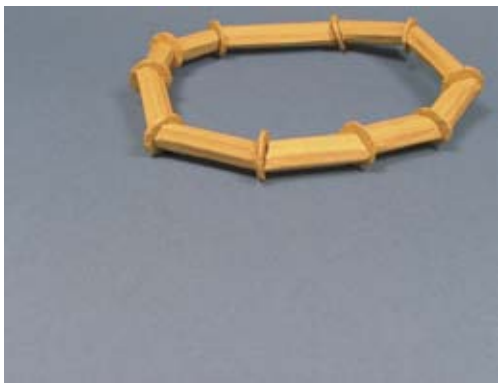


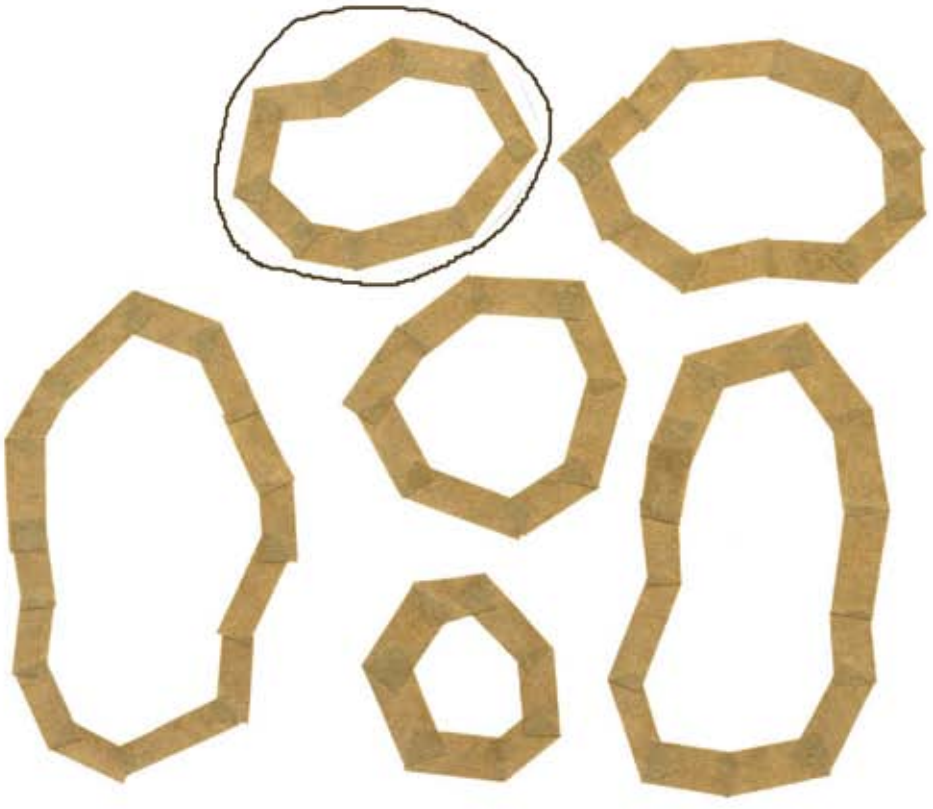


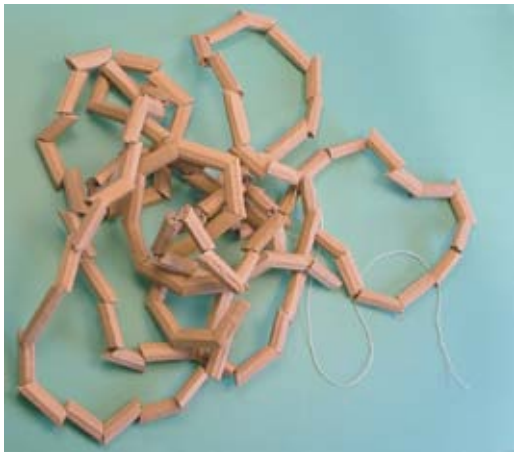


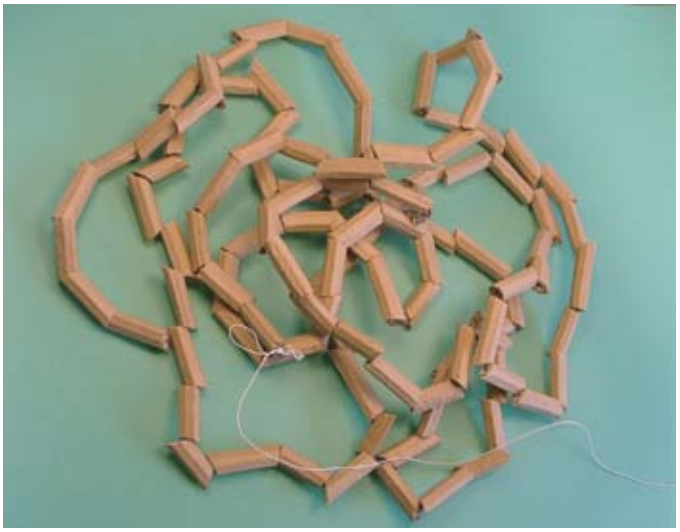


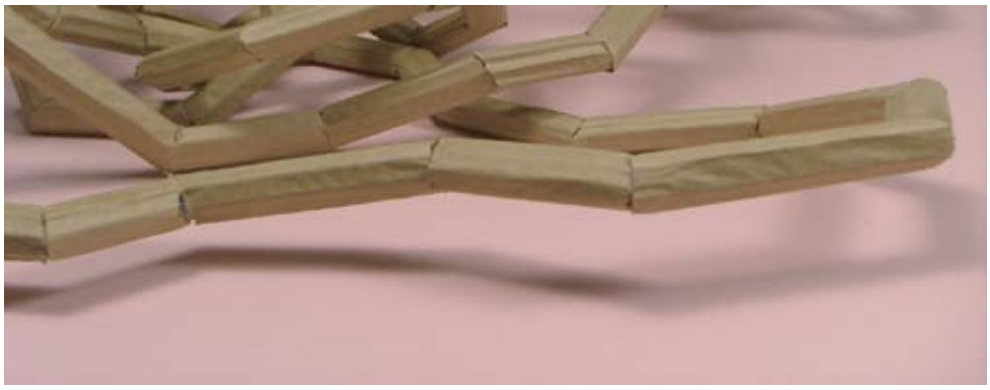



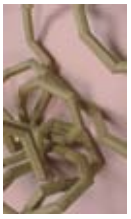


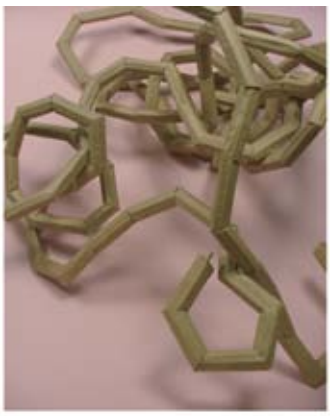
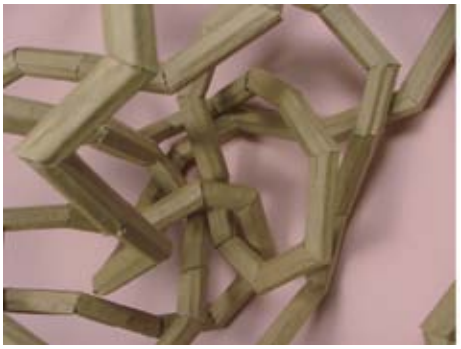






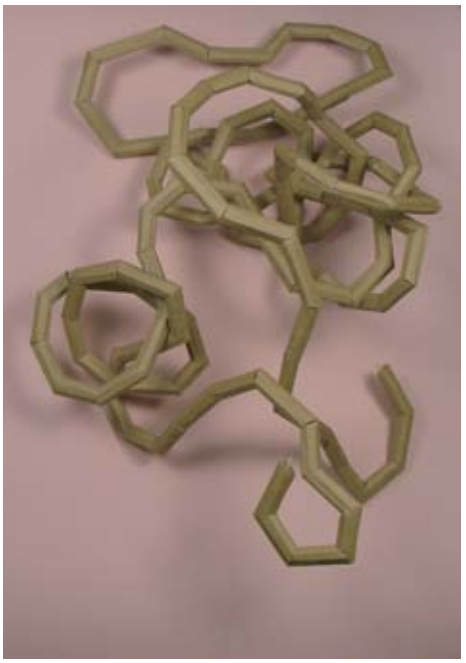


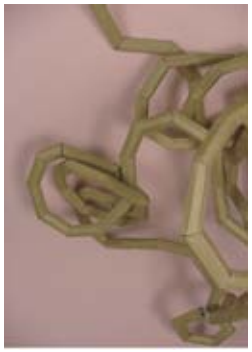


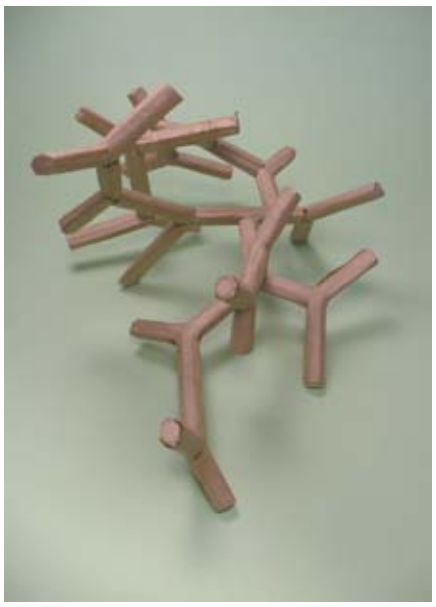



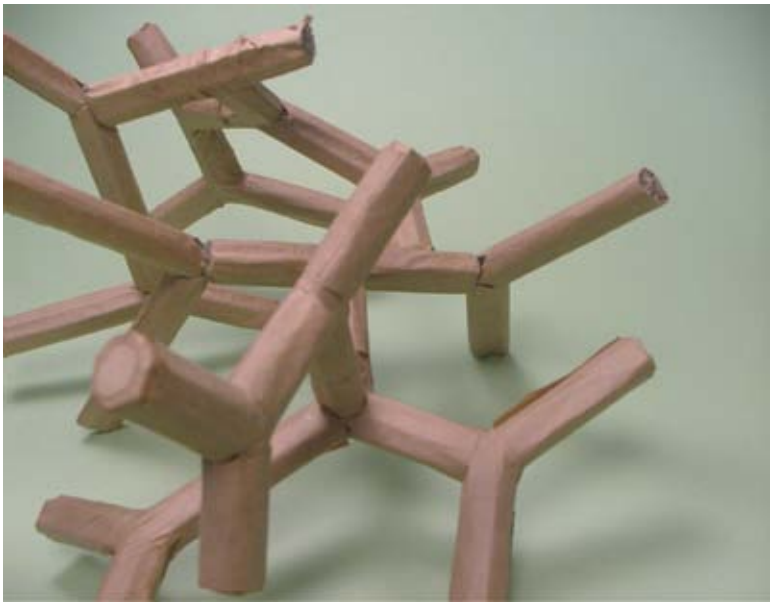


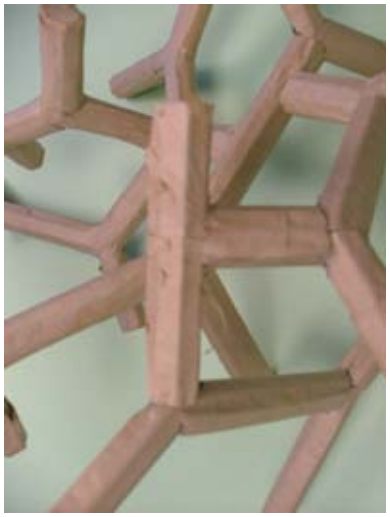


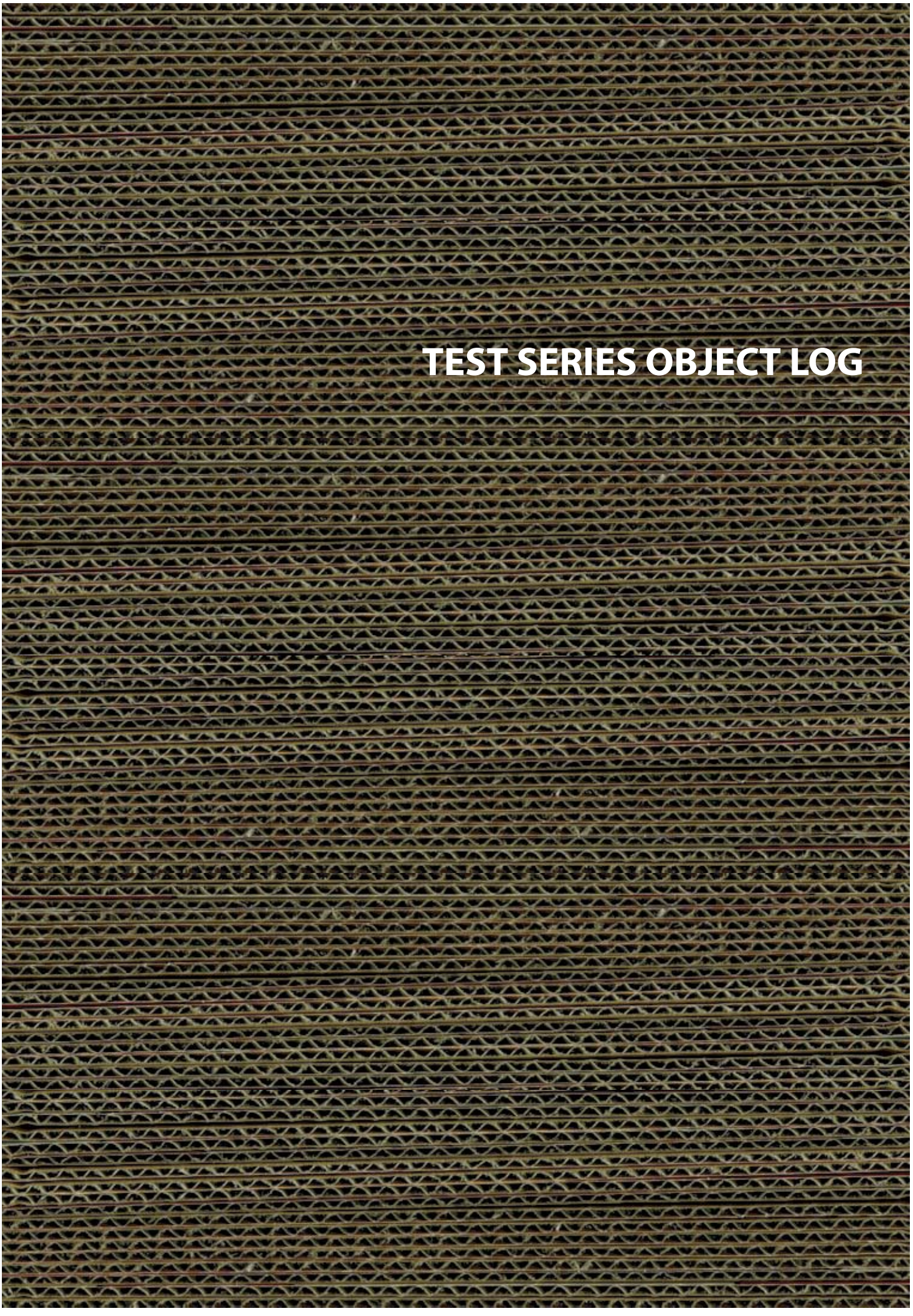




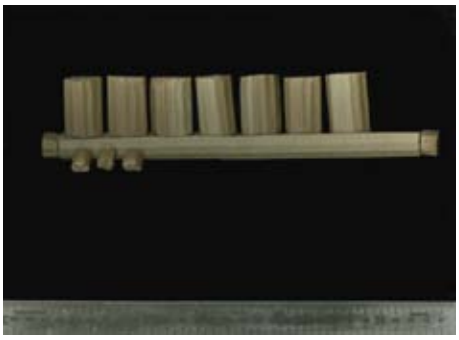


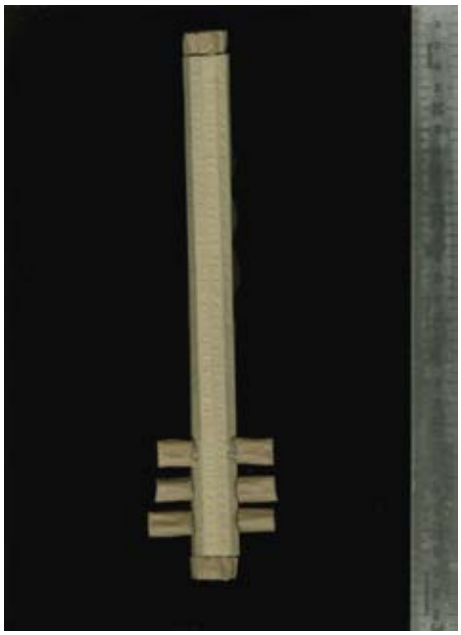


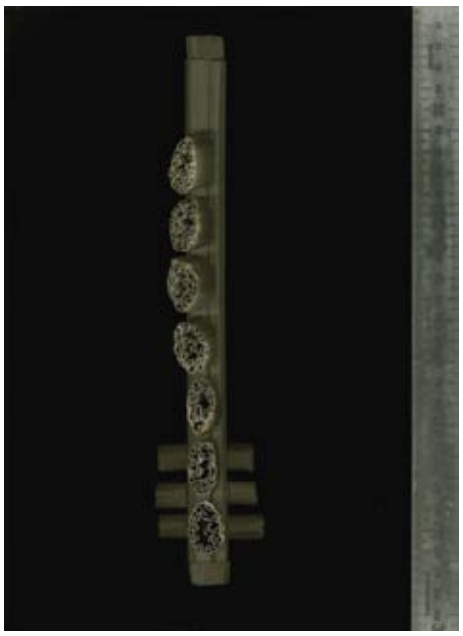

TEST SERIES OBJECT LOG

Friday 25 February 2005
1 – 2pm

OBJECT 1







Thinking about something with legs…..

Beginning a new work is not easy. I felt nervous and halfway through the hour of making felt that I had failed and should stop and think of a better way to begin the project. Still, it did feel good to return to object making. I was in a kind of dreamy headspace but I feel like an afternoon nap now.

The nature of the material inherently lends itself to construction of the tubular and this object reminds me of a pipe or a musical instrument. It looks like you could play it although it is not actually hollow. There is a receptive space at one end for blowing in air or sucking up smoke. (This reminds me of my Father. He never smoked a pipe but was dying of lung cancer after years of smoking when I began making these sorts of objects.) It's also like a ship or boat (a vessel) with six oars at the front. Direction and movement is implied. This activity and the six horizontal oar-like protrusions remind me of bugs. Even if it was alive it looks like these legs would move in tandem and the bug would swim across the surface.

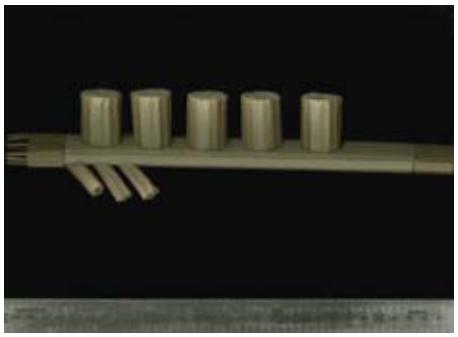
Maybe it's part of a gut or some other internal structure for moving substances or liquids. Perhaps all the tubes are continuous and have been severed in order to isolate the organ.

It also seems inert, empty, void with no purpose. Blank. Inactive. Like a model.

I've made very little attempt to hide the methods of construction. Hot glue is visible and the rolled up ends of the cardboard are in plain view. I like this layering, however, and it reminds me of the laminations of plywood or the layers in filo pastry. The object is obviously roughly constructed. I feel I'm all thumbs – a sort of thickness spread to my fingers, their dexterity lost.

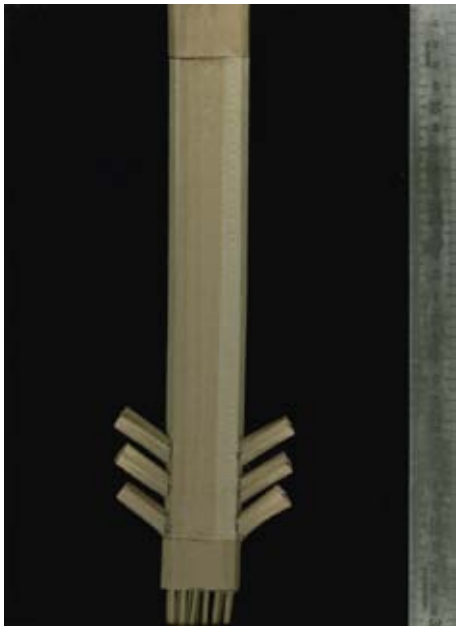
Object/abject. The abject log……

Saturday 26 February 2005
10 – 11pm



OBJECT 2

An hour is a long time. I must have been half asleep to have achieved so little yesterday. I was worried that I would finish too quickly today. Again I thought the experiment might be a failure and I should stop. How can sticking bits of cardboard together be so scary? (I'm scared that one false move this early on could set off a chain reaction...)



In relation to evolution and genetics, I'm concerned about how much 'replication' could, should and can occur. There's no point in me just endlessly making the same object. On the other hand change could happen so quickly that the physical formal relationships may not record the alterations. My consciousness of the process/experiment also affects what I make.

So object 2 does resemble object 1. It is more skillfully made. All the parts remaining are somewhat altered. The addition is a series of very small tubular extensions at one end that are constructed of rolled up water activated brown tape that you use for stretching paper.

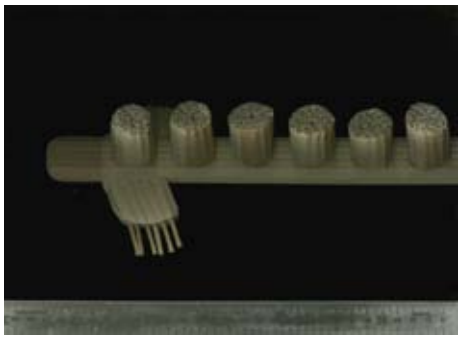
As I was making this object today I was thinking about ships. The fat tubes on top resemble funnels. I was planning to emphasise legs but decided against trying to construct something that is deliberately animal-like.

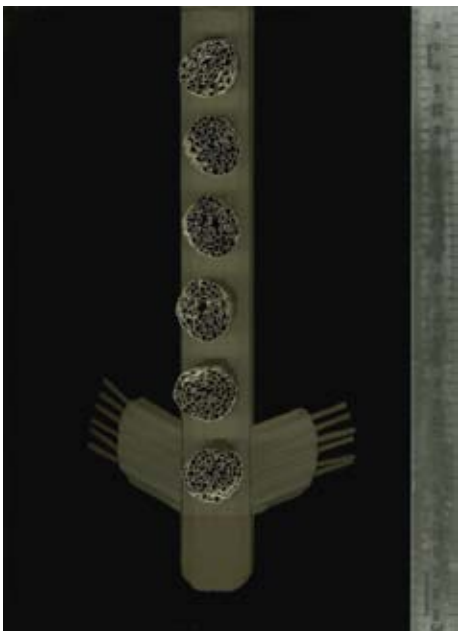
Overall I'm not sure what this object is. Is there a need to know or name at this stage? Perhaps these questions will become clearer as the project unfolds.

Today, I thought often about the project. Once it's established, I could have several threads going using different materials. These could begin in response to particularly interesting objects. It would allow for threads to cease also as the project would continue. From here it should develop a life of its own.

Sunday 27 February 2005
10.40 – 11.40pm

OBJECT 3





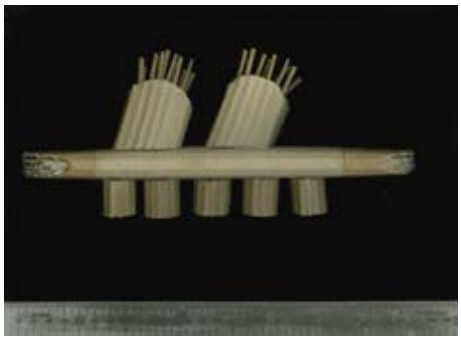
Already each day I'm starting later. It's already tomorrow as I write this.

This object has a curious resemblance to a koala or a platypus. The curved ends are somewhat like a bill and the small tubular extensions are now protruding from two angled larger extensions at the sides. I realized at the very end that they resemble paws and claws. The object has become very figurative – a central trunk, two arms, a head, a system of protrusions that are spaced evenly down the body. It is also symmetrical and sort of flat and two dimensional. It has a squashed or flattened appearance. I'd like to try to make these objects more three dimensional. This looks like something you'd peer down upon on a desk – which of course is exactly what I've been doing.

As I'm making, I'm thinking and the project is taking form in my head. As each thread develops it could exist independently from the original thread. Any thread could end – reach a natural conclusion, even the original (this one). A new thread could diverge from this one and employ a different material or method. For example, a thread using plasticine could develop. A new form could be made out of plasticine in response to one of these objects and continue on concurrently. The same lump of plasticine could be recycled and thus rather than the actual object remaining, there would be documentation and this is what would be part of the study in the next stage. A number of threads could be happening at once and these activities of making and writing could be happening several times a day. Any of these could cease at any time. An evolving rhizomic structure would ensue – with no real end – and the project could continue indefinitely.

Must stop, too tired…

Monday 28 February 2005
10.25 – 11.25pm



OBJECT 4

Oskar looked at object 3 today and said it looked like an echidna.

Tonight's object has LEGS. Ten legs. It reminds me of a dinosaur. It has literally crawled, in fact walked, out of the primordial soup of the project. It is a little too literal. A little bit like how aliens are visualized in popular culture. It's a little bit too obvious. However it's probably a necessary stage in the project. Maybe there **will** be lots of legs…

I was also thinking about a less object-based strand or thread of the project which is more concerned with composition and spatial relationships. I'm not quite sure how it would work. It might need to be constructed on a larger scale. The same materials could be used.

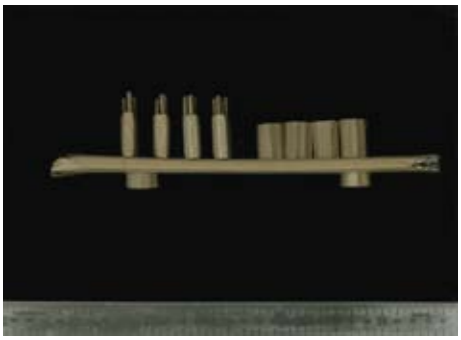
Going back to today's object. It has become elevated and less flattened. It has 4 fins on the top which have fine tubular protrusions. It appears to be very spiky. The angle of the fins and spikes indicate the front and back of the object.

I was thinking about memes and creativity and wondered if there had been any studies.

Again I must go to bed…

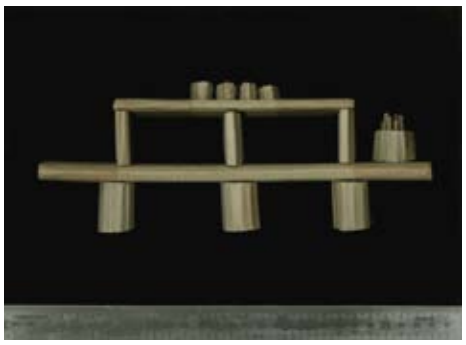
Tuesday 1 March 2005
10.20 – 11.20pm

OBJECT 5



I tried to select out the legs by moving them to the 'top' of the object/organism but I ended up adding four very short legs to the underbelly right at the very end. It now resembles a lizard with an architectural extension on its back. The fringed 'tail' seems a bit silly and decorative – perhaps redundant, a passing fad that won't be replicated.

Stephen just walked in and said it was another ship. He didn't see the legs and focused on the 'funnels'.



Friday 4 March 2005
12.00 – 1.00pm

OBJECT 6

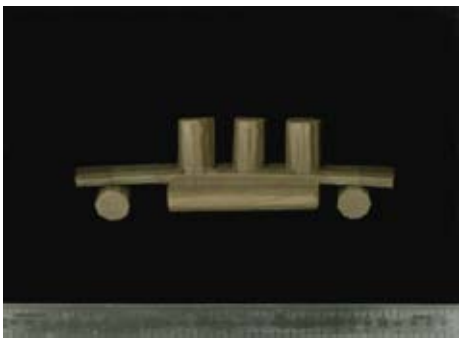
I have fallen behind in my construction so today I have two objects to make. Obviously the break in production and the production of both objects in such temporal proximity will affect the outcome. This is already apparent in this object.

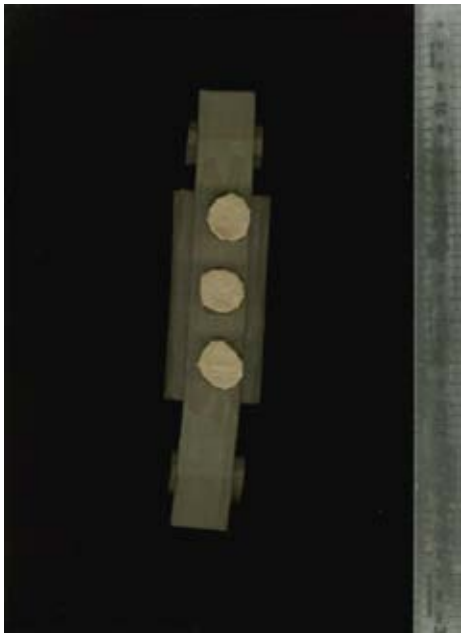
This object has six tubular 'legs'. The main body consists of a flattened tube as all the objects have thus far. This one, however, has 3 uprights with a second flattened tube – like a second story. On top are 4 short open sliced tubes. On one end on the first story is a thicker sliced tube with fine tubular extensions. This resembles a small head which was not intended and only noted when I sat down at the computer and looked at it from a different angle.

I feel ambivalent about this object. It is very angular and not particularly pleasing to me in an aesthetic sense. This in itself is not very important but still this object is somewhat lacking. Some parts are more finished and raw ends are closed off. This is probably more important as it speaks of a more distinct interiority. It is less porous. Some parts are impenetrable. These parts are separate and horizontal. All vertical components are open at least one end and porous at both the top and the bottom.

Friday 4 March 2005
2.45 – 3.45pm

OBJECT 7





Thinking about porosity had led to a radical shift. Perhaps my unease with the previous object's aesthetics was due to its involvement in this change. This object is sealed with tape at all possible orifices and some parts are completely covered in tape. Cylindrical parts have been attached with hot glue but also with tape in a sunburst pattern around the base of each one. There are two parts; one on top of the other, as in the last object but there is no space between them. The object has contracted and become smaller in all dimensions. It has wheels and a hanging underbelly and three funnels.

It looks like a vehicle although the wheels obviously can't rotate. It seems more finished, more handled, more intentionally designed than all the objects so far. It feels like a drawing, an outline, a model of something else. Very inert and useless.

Still it is very literal. I would like to make something more abstract, less recognizable that explores form without reference to external pressures.


RESEARCH SERIES OBJECT LOG

Friday 29 April

OBJECT 1

This is the first object in the new series of which there could be thousands of objects. I need to not focus too closely on each object. Each object is not meant to stand on its own but, in order to be successful, each object needs to be discrete and have its own identity. Even as an unresolved idea on its way to somewhere else, each object needs to have its own individuality. The reality of this means that the objects need individual attention, to be constructed with care and considered intently during construction. Then each object becomes secondary to the next object, acting as an inspiration, to be archived and not viewed until the next phase of the project.

I have been thinking of an endpoint where all the objects will be viewed as a field. The viewer will negotiate the space over a series of duckboards and raised bridges. This pathway will be of a modular construction giving it the flexibility to be set up in various sites. While it is useful to look towards the resolution of this work in this way, I think it also just needs to be allowed to be made - to exist without conditions imposed by current perceived future possibilities.

For me, making this work involves uncertainty. I think this gives freedom but also creates tension. This is my challenge – to work creatively with this tension and allow the work to unfold.

This object uses the worm as a reference point. The common earthworm *Caenorhabditis elegans* is an evolutionary simple organism that is related to many other living organisms. It has a relatively simple body – a tube with two openings, that acts primarily as a gut, a structure that processes and transforms other matter. Charles Darwin studied earthworms in his retirement. He was fascinated by their ability to rehabilitate wasteland through a collaborative digestion, to take in one thing and produce another. So, for me, the worm is a good place to start.

The object I have constructed is "worm-like". When my 5 year old son Oskar first saw it, he thought it was a snake. When I pointed out its 'spikes' or 'spines' he revised his interpretation to caterpillar. It is segmented; made up of a series of sections. Most of these segments are similar in length. The segments are joined with brown tape with slits cut into it so it can go comfortably around the tubes where they bend. At each end, the segments are slightly longer. Tiny rolled tubes of brown tape, 2-3mm in diameter, are glued to each section. This glue is visible as a small blob that the tube sits in. These protrusions can be read as spikes. The tubes join to form an 'S' shape. This object does not sit flat but rises up like a snake lifting its head.

I find my hands comfortable working with cardboard and water activated tape again. I am making known motions, remembering the tricks of the trade. Rolling up the tape is new but rolling as an action is not as I've been doing it with cardboard. But it also reminds me of the skill of rolling cigarettes that I used to smoke and of my Father's illness. I don't think I can roll paper without thinking of these things.

Tuesday 3 May

OBJECT 2

These objects and this process require my utmost commitment. Sometimes I worry about how committed I can be to cardboard, tape and hot glue. Since art can be anything or made out of anything it's not really an issue. More important than material or methods is the artist's commitment and belief in their work. Some people are

really good at making art out of nothing or out of something really ordinary and I admire this lightness in their approach.

This object resembles a bottlebrush. A short, central tube about 10cm long is covered by 1cm long rolled up tubes of water-activated tape that radiate around it. These tiny tubes are attached with a small blob of hot glue which has tiny bubbles in it. The glue reflects and catches the light like a jeweled fragment. I feel like it's underwater – a shiny coral polyp or glinting sea sponge. The extensions or tiny tubes remind me of the pneumatic tube feet I studied on echinoderms (starfish) in a 2nd year zoology subject. This subject was called Vertebrate Ontogeny and Phylogeny and I can remember being very disappointed that it was all about fish. I thought that we would be able to work through vertebrate development and arrive at human beings in a semester. Ontogeny is concerned with the development of an individual organism and phylogeny is concerned with the development or evolution of a kind or type of animal or plant. (Phylo- is derived from the Greek for tribe) This has an obvious resonance with this project. Perhaps each object's ontogeny could be traced through the writing concerned with conceptualization. Phylogeny could be studied through the physical and conceptual examination of the entire group.

These tube feet endow the object with the possibility of movement and the numbers of them (around 70) give me the feeling of marching when the tubes are in contact with a surface. It could also roll along. Perhaps these tubes/extensions/feet have suckers on the end of them and it could climb a vertical surface. Perhaps there should be many of these – a colony. It does seem diminutive, needing some kind of protection, safety in numbers, a clan.

It could also be a tree trunk or branch or a log. Branches have been cut off. The shadows of these extensions are interesting. Shadows as a representation of these objects could be an interesting way to study them as a group.

Oskar thinks this object looks like an echidna or a slice off the end of a dinosaur tail. Stephen is reminded of one of his mum's hair rollers. I'm back thinking of grevillias and bottlebrushes. It's interesting that these simple cardboard objects can oscillate between flora and fauna and inanimate objects so readily.

Friday 6 May

OBJECT 3

I was thinking of the red bottlebrush when I started making this object – *Callistemon phoenicus.* Strangely, when I look at this new object I can see smaller bottlebrushes but also weapons.

It interests me how quickly these objects become something else. This object has little resemblance to a worm. It is still of tubular construction but is now splitting/branching/bifurcating. From the single centralized, symmetrical

trunk- body of the previous object, this object now branches out into opposite directions. Two branches jut out perpendicular to the thicker central tube. The ends of these branches bear spiky 1cm extensions in rolled brown tape. Tiny globules of translucent glue hold them in place. One branch is thicker than the other. Both join a central trunk. All ends are still raw, unfinished and porous. You could suck water up the central tube like a straw or blow air through it. Like a musical instrument responds to the pressure of breath, could these objects have a voice?

I am struck by my vision of weaponry and the two miniature maces projecting out from the object's central trunk. These objects could fly into space. Why not two hairbrushes (round ones for blow drying in curls) on a stick? Does this need to be logical? Not necessarily……

I must admit I feel uneasy about this object. Perhaps it is in some way transitional. It is less convincing, less sure of its own presence. Still in the early stages of the series being number three may have some resonance. Perhaps I haven't given it the attention that the first two had – like an overlooked middle child. However, if thousands of these are made then being the third may not be so bad after all. The good thing about this condition is that it urges me to continue - to discover this object's trajectory.

For Oskar, this object is reminiscent of poles and traffic lights. The central pole is the ground. Another branches off as a traffic light, the other is underground. The pole acts as surface and border. The object is oriented horizontally rather than vertically.

Friday 6 May

OBJECT 4

I couldn't resist the idea of branching and I had an urge even last time to use the hot glue globules as an element in themselves. Oskar saw the branch immediately but when I asked if he could see anything else, he said it was like a city and went back to his lego.

This object consists of four main sections that branch off each other. At the end of each of these tubes are tiny globules of hot glue arranged evenly around the flattened sides of the corrugated tubes. Lines of these globules circumnavigate each tube. On longer branches, there are four lines, on the smaller branches there are two lines of reflective glue globules. This is where Oskar saw the city. The ends seem to be illuminated, like tall city buildings. It is a curious combination. Maybe this branch is a tree house – perhaps a fantastic new architectural style. A model for a massive structure.

I'm more excited about the possibilities of where to go from here. The process is carrying itself along. I feel an urgency in the making, in taking steps towards a large and possibly ever growing collection. The conditions of making are compelling for me. It allows a quietness, a density of space where everything else slows down and becomes secondary to the conceptual, material construction. It's this quietness and the spaces in between the thinking of the making that I crave. And the sensuality of the materials, the familiarity of the feel of the tape and cardboard, the heat of the glue gun and the sharpness of the Stanley knife as it slices through and between the corrugations of the cardboard…

Monday 9 May

OBJECT 5

This object took far too long to make so I'm not sure how it will be followed. It is still botanical. In fact it appears that another branch of the previous object has grown a fruiting body - a large bulbous, weighty structure on the end of the branch that threatens to topple the whole object. Like a big, fat fruit bending the branch of a fruit tree. Pendulous. This fruit is not curvaceous and fecund but linear and angular. It resembles a rough computer generated object constructed of flat triangles and irregular rectangles. It approximates a sphere but is lumpy and misshapen. The end is heavy, like a hammer. This fruit wants to fall out of your hand. The tube this fruit has grown on the end of has a secondary branch very similar to the last object. It has tiny globules of hot glue on its end – a row of four.

This object makes me think of slime moulds. These organisms form fruiting bodies called sporangia which are basically clusters of spores on the end of stems. These are quite novel and interesting structures – a sort of microscopic flower. What's even more interesting is that slime moulds are the result of groups of individual single cell amoeba swarming together to form a colony that facilitates their reproduction. They collaborate and then thousands more amoeba are produced.

The object also reminds me of a sceptre that a monarch holds –an emblem of power. I was originally thinking of encrusting it with glue globules but I decided to leave it unadorned. Perhaps the next object lies here….

This object relates to some other forms I have made outside of this project. They are like the large cardboard boulders made of cardboard that sit next to my desk in my studio. I don't know how to negate the effects of these other objects around me. Do I need to sit in a totally empty, white room to just construct? Is it possible to mediate a position of neutrality? I don't think so. Every little thing I do exerts an effect on the project – like the butterfly effect that theorises that something as simple as the flap of the wings of a butterfly can effect the weather on the other side of the world. This is based on the notion of that the initial conditions are extremely sensitive to change, however small. Similarly, I wonder how different the project might have been if I'd chosen a different starting point or if I'd retained different parts of certain objects. Is it possible to predict or model such a course? Or is it like weather forecasting where the underlying conditions are too complex to reliably predict what the weather will be like in a few days time. That is, that it's not so much that one tiny event could cause a major weather event on the other side of the world but that there are so many tiny events that can't be measured affecting the weather that forecasting is impossible.

I think subconsciously I wanted to make this object because it is part of another work that I have had to shelve as I don't have time to explore it at the moment.

Friday 13 May

OBJECT 6

I tried to simplify the form of the previous object but although the secondary branch has been discarded, the fruit on the end of a branch has persisted. I have been reading about evolution and natural selection and wonder what sort of rules I can or should impose on the process. The forms are changing rapidly and I wonder if this should concern me. Evolution by natural selection occurs extremely gradually. Small changes or adaptations are slowly selected and cumulatively create new forms. No one is in control of these changes – they simply unfold according to the prevailing selection pressures. There is no particular outcome in sight. I am trying to not control the construction of the collection as a whole and I'm trying not to actively look forwards or even backwards. However, I can't forget what has been made and I can't help but look towards particular futures no matter how 'open' I try to make my outlook. I am subjective. I aesthetically prefer some objects over others. My hands are more adept making some motions than others. My materials restrain me and compel me in certain directions.

As I think/write about this 'problem', I realise that this is a good problem to have. This project, while structured and well defined in one way, is unruly and wilful in others. This unruly wilfulness is the force under which the work must develop and evolve. The forms my objects take are selected for by my subjectivity, my skill, my thinking, my own interests, my energy on a certain day, the responses of others, the books I read, the spaces in which they are constructed etc etc. These conditions are constantly in flux and as each object directly references the previous object the thread continues.

Some of these conditions are outside of my awareness, are subconscious. I am also aware of the control I have and the decisions I make as each object is constructed. The hollow form at the end of this and the previous object is one that I'm going to have to select out. While they are aesthetically very pleasing to me, the construction time is lengthy and I start to feel bogged down in the technicalities of measuring and cutting and carefully gluing parts together. Perhaps time is more important in the construction process than I have acknowledged. I did plan to spend 30 minutes actually putting the objects together – not including the time preparing parts in advance. (This is necessary as the water activated tape needs to dry. Although I have been able to speed this up with my heater now the weather is colder.)

I thought, as I made this object, I could simplify the hollow form made of triangles and rectangles perhaps by flattening it but it seems to have at least as many pieces as the last one. Maybe there are even more. I can't check as the predecessor has already been archived and is in my other studio. This one has about 20 pieces, each cut individually and bevelled on the underside to fit together. On one face is a group of 1cm rolled tiny tubes of brown tape glued on with a globule of hot glue as previously noted. These tubes or extensions all extend in the same direction parallel to each other and perpendicular to the face of the hollow form. It doesn't feel so much like a fruit anymore although it is still weighty. It swings around in my hand wanting to face downwards, that is assuming that the front is where the tubes are sited and the back is where the central tube joins to the hollow form. I guess a hammer and other hand tools would do the same thing.

Stephen said it looks like something useful. He said - "We need one of those."

Tuesday 17 May

OBJECT 7

Back on track, I am still trying to simplify the hollow form. This time it has 12 faces and is more like a misshapen cube. It is on the end of a cardboard tube and attached in a similar method to the previous object. The tube is diagonally sliced and glued to the corner of one of the faces. Again the object swings around to expose this external join. This reminds me that I haven't mentioned this join before. In object 5, the tube pierces the hollow fruit. The join is concealed. The excessive, big blobs of hot glue that I allowed to slide down the tube on the inside of the form are not visible. With this object and the last, the two parts have a visible separateness. The hollow form is a discrete object stuck on to a tube or stick; another discrete object. This has only become significant in retrospect. Perhaps this object could evolve to lose the tube. Although if I'm trying to alter or select out the hollow form then maybe it is the tube that remains.

I'm still thinking about natural selection and how the process of adaptation is cumulative and ongoing. In nature, the focus is on improving the organism so that it is better suited to its environment and has a better chance of surviving or persisting genetically. In my project, one of the forces is my own judgement. This judgement is continually modified by my constantly changing ideas. I don't think I want my objects to improve as such. But I can only assume that my judgement is skewed by my position at a particular point in history or more specifically, the history of this project. Perhaps this hollow form will disappear and become part of the history of this project. Perhaps it will persist.

This particular hollow form still has a series of 1cm tubes of brown paper glued to it. They form a line which follows the joins between faces on the two opposing ends of the object which run perpendicular to the tube. There are 44 tubes in total - twenty on the end of the cube at the end of tube and 24 on the cube end adjacent to the uncut tube. (I've often thought it would be interesting to ask someone else to construct these objects from their descriptions. I'm sure they would be totally different. In fact I'm not trying to exactly describe or I would include exhaustive measurements and descriptions. I am leaving that for the next part of the project. It would also be interesting to study the evolution of an object by asking a series of people to respond by making an object in response and then passing it on to the next person to respond to. This also brings to mind the way genetic information is passed on as a series of coded instructions for constructing various proteins. These instructions are contained in genes and are called the geneotype. The descriptions in this project could become a genotype and the expression of these instructions would be the phenotype. A series of people could be given the same genotype and a range of phenotypes could be produced.)

Wednesday 18 May

OBJECT 8

It's interesting that although I keep trying to change their form, the last 3 or 4 objects are very similar. In a way it's not surprising as I was concerned that the earlier objects were too formally divergent. This reminds me of a thought I had about trying to endlessly reproduce the same object to mimic evolution. At first I thought this impossible or pointless but then I realised that I could try to make the same object over and over again. Then

perhaps a gradual change would be revealed. I would need to follow a similar process. Make an object, copy the original, archive the original, copy the copy, archive the copy, copy the copy of the copy, archive the copy of the copy etc etc.

This object has a longer stick/rod with four flat sides – two corrugations of the cardboard under each. On the end is a hollow form like a fat tube with six flat irregular triangles and rectangles on the sides with 1cm rolled tubes covering the ends. There are about 40 tubes on each end. The ends are not constructed of cardboard but have the brown tape over them. The tubes are glued on with hot glue. The tape creates a curved surface for the tube to adhere to.

I see this object as figurative – a head on a stick or limbless trunk. The tubes are hair, beard, teeth. I don't like it much. I am judging it and of course I can see how silly I'm being…

Stephen thinks it looks like a meat tenderiser and I wonder why I didn't see that. He then says that this whole process reminds him of Rorschach tests. That my questioning is all about subjective perception and it doesn't matter how he responds because there is no wrong answer.

Friday 20 May

OBJECT 9

A change has occurred and the form is resolving itself. I feel like it is starting to take on its own life. Although I have been trying to change the form, it has been resistant. Suddenly it has simplified itself. I was thinking of the idea of punctuated equilibrium in which evolution occurs in fits and starts rather than as a slow continuous project with gradual changes occurring in equal intervals. This allows for relative stasis where little or no change occurs and ruptures where big changes occur suddenly. Generally this stasis is lengthy and the ruptures are short and at times revolutionary

This object is about 25cm long with a central rod of tubular coiled cardboard. The tube is about 2cm in diameter. It has a certain thickness or heaviness in comparison to the rest of the object. This rod is open and porous at one end the other end is covered by what I call a 'biscuit'. This is a cardboard disc about the size of a water cracker, maybe slightly smaller and thicker – about 4mm. It is constructed of two round pieces of cardboard glued together. The edges are covered in brown tape. The flat surface has another circular piece of brown tape that is thicker and lighter in colour. (I bought this tape when I was painting for stretching paper and have not been able to find the same tape again so it is reserved for special and limited usage.) The tape is cut in a rough circle smaller than the surface of the 'biscuit'. (It reminds me of iced biscuits bought from the supermarket.) The 'biscuit' is glued to the end of the tube covering it and closing it off. The tube is glued to the face of the biscuit close to one edge. The other side of the biscuit has 19 tiny 1cm tape tubes glued to it with tiny globules of hot glue as described on many of the previous objects. There is a second biscuit about one

quarter of the way down the tube. It is set into the tube so that about one third of the 'biscuit' perforates it. It is glued inside a slit cut into the tube. On the opposing side of the biscuit are 16 brown tape tubes attached in the same manner. The reduced number accounting for the part of the biscuit inserted in the tube. The biscuits and their tubular extensions seem to be pushing something apart to create the space in between their planar faces. It reminds me of a dental or medical instrument holding something open. It is just the right size, or maybe a little large, for holding open a mouth. It reminds me of the discomfort of the dentist. The discs or 'biscuits' are like the mirror the dentist uses to see around corners in your mouth. It is like a simplified periscopic device. I wonder how long dentists have been using these mirrors and what they're called? Forgetting my dislike of the dentist, these mirrors are a simple and elegant solution.

It is interesting to ask questions about what the objects might do rather than what they look like - to consider possible operations they could undertake and to see them as active rather than passive. It would be interesting to ask an individual to sit down and look through the entire collection and suggest purposes for each object. This could be an extension of the study.

I am reminded of how useful this writing is to the project. While I feel uncomfortable about the public nature of it at times, it allows me to process ideas and gives space for other ideas to surface. Some of these ideas will just float, others will be put into practice…

Tuesday 24 May

OBJECT 10

Again, I feel I am in a transitional space. This object is lighter, more tentative in the way it exerts its presence. It was constructed quickly. There was an urgency in its conception. It also seems more decorative and less functional than its predecessor.

The central tube is still residual although this time it is slightly longer and thinner. There are now 4 smaller

biscuits similar to those used in the previous object, one of which is glued to one end of the tube. This biscuit is about the size of a ten cent piece. The other end of the tube is sealed by hot glue that is flush with the flat cut end of the tube. The glue fills the corrugations of the coiled cardboard especially in the centre. The three other biscuits are slightly bigger and are about the size and thickness of a twenty cent piece. They are inset into the tube via a sliced section and glued in place. On one side of the biscuit are 4 to 6cm tubes of brown tape set in a globule of hot glue at an angle of about 50 degrees. On the previous object they were vertical and appeared to be more orderly. Here they appear more fragile and informal. The other side of the 'biscuit' is covered with globules of glue. The smallest 'biscuit' on the end has 3 globules on its underside – if the object is oriented in this way. The other 'biscuits' have 4 to 6 globules.

To be honest with myself, I have a motive for cutting and inserting the 'biscuits'. I am trying to break up the centrality of the tube trunk. I want it to fragment and become dispersed within the object. I want it to become one of the parts rather than the main part and to alter the hierarchy of parts. I also want to alter the dimensionality of the object. While the objects are obviously 3 dimensional, many of them seem to have a singular viewing point. They appear to have a dominant orientation. I want the collection to become more fully formed. I want to suppress hierarchies and centrality so the objects can be viewed/held/considered from multiple view points.

Another layer of perceptive analysis for the viewer : what does the footprint or shadow remind you of?

Tuesday 24 May

OBJECT 11

This object quickly followed the previous and my intent seems obvious as I write. However, I am still considering how much I control the process and how much it controls me even as I write about how I am motivated to exert change.

The central tube of this object has now been broken up into 4 uneven pieces - three pieces of about 3.5 – 6 cm and a longer 18cm piece. Between each tube is a biscuit. The tube is still continuous and relatively straight despite the interruptions. The shortest tube is at one end of the object. Both ends are sealed by a biscuit and all biscuits have tiny globules of hot glue on both sides. The shortest tube has rows of tiny tubes of 1cm rolled brown paper tubes attached with globules of hot glue. These rows run along the flattened corrugations of the tube of which there are seven. Each row has 4 tubes on it with a total of 28 tubes.

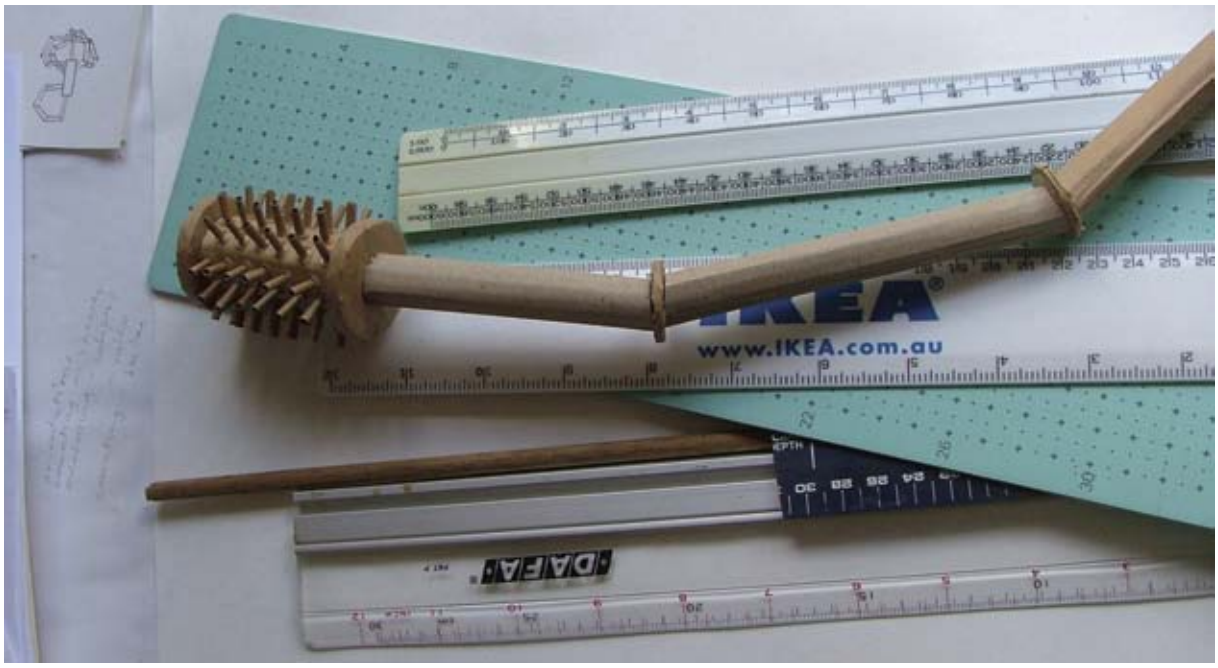
It looks like a model of a piece of agricultural machinery. In my mind, I can see the end with the tubes churning the soil or spraying water or pesticides. Like the tubes and vacuum that moves automatically around the bottom of a swimming pool, this machinery moves independently around the fields. Mutely it processes and organises the matter of farming – this diminutive model over wide, flat fields.

Friday 3 June

OBJECT 12

It's been over a week since I constructed the last couple of objects. I realise how easy it is to become distanced from the project and subsumed by the demands of the rest of my life. I feel like I've lost contact with the project and feel outside of it. It's essential that my position is one of interiority and that I remain an active participant.

This object is longer. Some kind of growth is occurring. It is bigger and commands more of my attention than the last two or three objects. Is it an improved version of the last object? Again it is segmented. There are 4



main tubular sections. Each segment is joined at a slight angle facilitating a bend in the form. Each section has a 'biscuit' either on the end of it or between it and the next segment. The shortest segment is at one end of the object. Although it is shorter than the other segments, it is also thicker. It has a thicker 'biscuit on either end. The other 'biscuits' are thinner and smaller like 10 cent pieces. The thicker segment dominates the object. It is covered in 1cm brown tape tiny tubes glued on in a drop of hot glue as previously described. (Should I describe each object as if the description needs to able to stand alone or can it refer to other objects as it does here?) The tubes are glued on in rows along the flat corrugations of which there are 12. In total there are 72 tiny tubes. They seem very regular. This object seems more controlled than the last. It doesn't seem as capable of managing a change in scale as the last. Its position is more fixed. It is like a desk-bound, hand-held tool. It has lost some of the spontaneity explicit in the last two objects. It is more controlled and considered.

Wednesday 8 June

OBJECT 13

The form is bending. The two ends are straining to meet each other, to touch. This reminds me of phototropism, of plants moving towards the sun or another light source. This object is displaying a 'tropism'. It is so similar to the previous object that it appears movement has occurred. A series of objects that change gradually could be animated so they appear to morph into each other. To become each other…

The bending of the tube into a shallow 'C' is not the only difference. It also has fewer of the 1cm tape tubes. The rows are incomplete and there are spaces in between the tubes. There are 51 tubes in total. They remind me of the inside of the mechanism of a music box. If this end of the object was applied to a material that yielded to the tubes as they turned, a sound could be made in response.

The object has a handle and a focal point. Holding it is like holding a drooping flower. It has a certain fragility. In fact it could break. The form is weakened by the division of the central tube into 4 pieces. Will the ends of the object meet in the next object or will another structure be constructed on the opposing end? Perhaps branching could occur? Or maybe the next form will still be very similar?

Today I was reading a glossary of phylogenetic terms and came across the term anagenesis which is evolution along an unbranching line without a lineage split. Speciation generally occurs when the lineage splits and enough accumulated changes occur that the organisms can no longer interbreed (cladogenesis). However,

a new species can develop over the same lineage if enough changes occur over time and the old species dies out. Can I use the specifics of evolutionary biology as a model for understanding/analysing my project? My objects are not biologically alive and cannot interbreed in the traditional sense. The part of the project that is 'alive' is my thinking process. I cannot split into two people and independently work on two different lineages. I have considered the possibility that I could have a city lineage (which I only work in my studio at RMIT) and a Coburg lineage (which I only work on at home). I should at least be noting the site of production. (Retrospectively I can note that all objects made on Tuesdays were made in the city studio.) However, even if I split the site of production, I cannot negate my awareness of what was constructed at the other site. I may have no choice but to construct an unbranching chronological lineage. Can I chronologically layer production by going back to earlier objects and creating new lineages or species? Is collaboration the key – maybe more than one person could work on the project? What if the evolution of organisms was collapsed down and organisms, as they emerged as species, were ordered chronologically? Is my emphasis on chronology misguided at this point? Perhaps when I reach the stage of analysing a complete collection, I will be able to suppress chronology and work on an analysis of form? Will this analysis include this writing and these ideas in some way? How important is the notation of these ideas to the next stage of the project?

Friday 1 July

OBJECT 14

Perhaps I am missing the point in some way. In the case of the butterfly effect, one tiny flap is theorised to have a massive effect on the other side of the world. In the biological world, a myriad of events are occurring at any one moment. While this might result in separate species, these different organisms exist simultaneously and exert an effect through their mere presence. So if an analysis of biological events focused on chronology, the result could be like a list - a linear account of history. As I construct my objects, at times all I can see is the linearity, especially as I construct one object after another. In a way, I've forgotten one of the reasons why I began this work. I wanted to explore the complexity of how my thoughts were connected and developed. I wanted to make work that reflected this by developing a project that appears well rounded and formed but is chaotic and fascinating on the inside. A work that is made up of many parts - parts that relate to each other in unpredictable ways. A work that is wilful and unruly…

The materials and the process exert themselves to their own ends. I'll find myself with an idea, thinking that if I work in a particular way, a particular outcome will result. Instead I'll find I'll cut a tube or glue on a biscuit and discover that the angle is not right and it's bending differently to how I intended. If the object HAD to be right I'd start again until it was exact. Using this process, I have to accept the result as a given, go with it and continue…

I began making this object two weeks ago. It was easy to pick it up and continue although the first thing I had to do was to pull it apart and insert two short pieces of doweling to strengthen it. Is this bending the rules? Is this form sustainable? What if I reach a dead end?

The structural problem is obvious. The tubes have a biscuit sandwiched between them. This is the weak point. This separates the tubes and breaks up the object which is exactly what I thought I wanted to do! The tubes can still be broken up but they need to be joined more directly.

This object is curving into a more definite C shape. It is now double ended with a thicker tube on both ends. It is symmetrical. The ends have unevenly placed little tubes glued to them but only around half the tube. If it is held in the centre, the object feels like a telephone. There is a mouth piece to speak into but the other

receptive part is above the ear, over the head. Perhaps the connection is between hair on the head and facial hair. Simultaneous grooming device?

It's been raining and cold. The cardboard is softer, squishier, and more receptive.

I've would like to create portable laboratories to house the collection. The collection could travel to different sites for analysis. It could travel in a portable display case like a travelling salesman's case. In my mind's eye this looks like a tall fat suitcase that opens up on its end and has wheels. This could contain the collection (or part of it) which could be taken out and placed on trestle tables or other temporary structure in order to do field work. This field could be a gallery as part of an exhibition. The exhibition may involve the viewer in the analysis.

Friday 15 July

OBJECT 15

I've been thinking about the ways in which I can represent the differences (or similarities) that are occurring over time as I construct the collection. If I record/photograph the differences between objects or in fact the similarities, these records will act as fragments or traces of the project's geneaology. I am in the curious position of being both 'creator' (and I am purposely referring to creationism) as well as looking to the future analysis of the collection. Obviously, my analysis will be affected by my intimacy with the collection. This is why it would be very interesting, in the future, to ask a series of other specialists whose areas of knowledge are mediated through formal relations to organise the collection. People who work in areas where the construction of knowledge systems are mediated through systematics and taxonomic relationships - botany, archaeology, evolutionary biology, microbiology, museology etc.

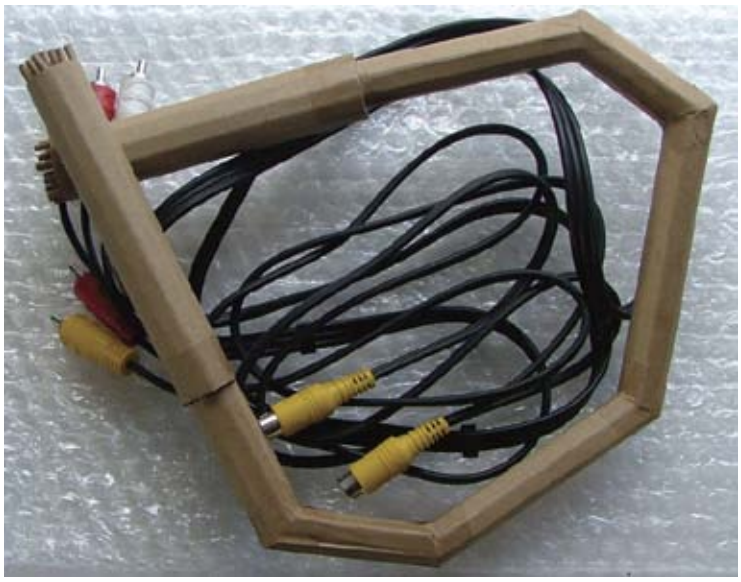
This object has a pleasing simplicity. It resembles a piece of sound equipment - not something that makes sound, but a lead which carries electrical impulses, that transfers an action from one place to another, an analog object. The object consists of 7 tubular parts. The biscuits used in the previous objects have been discarded but there are small pieces of dowel within the structure strengthening it and giving the form rigidity. There are four joins which are strengthened on the exterior with brown tape with slits cut into it allowing it to fan out and fit over the tubes like a sleeve. The object forms a tight 'C' form with the ends almost meeting. Both ends tubes are of greater diameter – one only slightly bigger than the other 5 tubes, the other almost double the diameter. The bigger end lies flush with the ground. The other rises up, propelled by the tube before it at an angle of about 30 degrees. On the end of this rising tube are 15 of the tiny tubes which are inserted into the end of the open

end of the tube. Shiny, light reflecting hot glue is visible as the agent of attachment. The bigger tube has 23 tiny tubes inserted in its end. In the centre is a larger tube of about 5mm in diameter. These thicker tubes on the two ends of the structure are also strengthened with dowel but do not have exterior strengthening.

The tiny tubes on the ends appear to extend through the whole tubular object. If this is the case, then why are there 15 at one end and 23 at the other with a larger central tube? If some kind of information is transmitted it must be splitting and being rerouted or looping and merging and mutating if it is travelling in the other direction. This object also has the potential to join to another object - for the pins at each end to plug into something. These are the male ends which will plug into the female end. Do leads usually only have one male and one female end? Perhaps this object has female plugs and it is the pins from an adjoining lead which are visible in the ends?

Friday 15 July

OBJECT 16



This object is very similar to the previous one. They were completed on the same day so temporally have a very close relationship. It is constructed of eight tubes – six of the same diameter and two on the ends which are slightly bigger. It would be more constructive, due to the objects proximity, to discuss the differences. Overall, the biggest difference, in a macro view, is that the 'C' has closed, ends have met, converged. It's not quite an 'O' - it is an 'O' which comes to a point on one side like the shape of a teardrop. The ends meet by one end resting on the end of the other. As there is no clue to any particular orientation of the object, either end can be considered to be resting on the other. The smaller end has 15 'pins', the slightly larger has 20 'pins'. These pins are not attached with hot glue, instead small globs of PVA were inserted with the glue. The PVA is less visible. Instead of sitting on top of the cardboard, the PVA is absorbed into the cardboard, flowing into the spaces between the fibres.

Friday 29 July

OBJECT 17

One end of the object now has a loop of tubes which resembles a handle. If I count all the tubular sections there are eleven although four of them form the looped 'handle'. The handle has replaced one of the pin plug ends and transformed it into a hand held tool. Something that is propelled from the body outwards - a weapon, a gun? The handle reminds me of a trigger. But it appears utilitarian in a friendly way -as something useful in the home or garden. It reminds me of a weed wand or whipper snipper. Curiously the tubes coming out of the handle curve around and loop under themselves. If I hold the handle of the object in front of me, the other end of the object points to my left. This end is very similar to that of the previous object. It is thicker than the other tubes and has one longer, thicker pin slightly off-centre which is surrounded by 29 smaller pins. The longer tube protrudes from the end.

If this project assumes to use evolution as a model, then there are questions that could be asked about how these

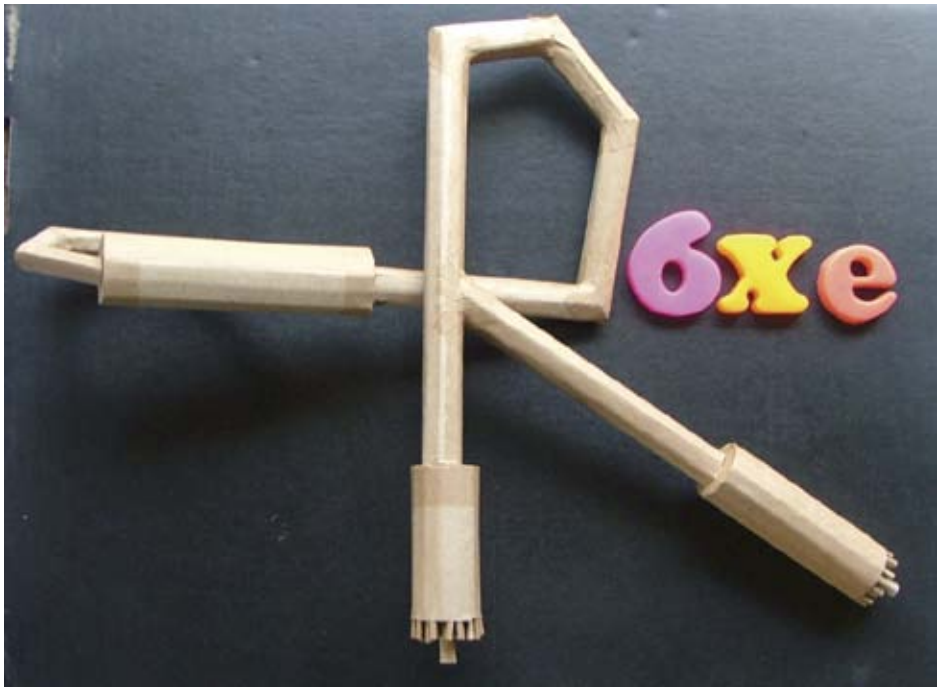
objects proliferate. In the biological world, organism that reproduce sexually involve the genetic makeup of two distinct beings that is expressed differently each time they reproduce. If each previous object is considered to be the parent object and the next object the child then why aren't all the objects the same? If this process was parthenogenetic(no fertilisation, a virgin birth) then each object would be a clone of the parent or previous. In the case of this project, the information used to create the next object is developed in response to the previous. The object is a product of the previous object and my response to it. The source of the response doesn't change but my response would be affected by a range of conditions including, for example, the weather(it's raining outside), the time of day(night), day of the week(Friday), the temperature (cold but the heater is warm under the desk), how I'm feeling emotionally (generally ok) etc, etc. Perhaps these conditions and my changing thoughts meet Darwin's principle of individual variation in the variations in the 'event' of making. These conditions are never the same as no moment in time is identical to another. Reproductive proliferation could be met via the production of a large number of objects and natural selection via the choices made in the construction of the next object.

Friday 5 August

OBJECT 18

This object is very similar to the last. It has 13 tubular sections, 5 of which make up the 'handle'. The tubular sections also extend out from the handle and loop around to the left. There are subtle differences –the handle is slightly bigger having an extra tubular piece. The tubes are slightly longer. The real departure occurs where the ends divide, branching into two so that it is budding and reproducing itself within itself. Both ends have protruding pins with a central, thicker pin. One points directly to the left and the other is at an angle of about 90 degrees in comparison. The first has 33 pins in total. The other has 31 pins. The shape of the loop strongly resembles the capital letter R. To see the shape correctly orientated as a letter, the object needs to be turned over. If this object propels something, it is shooting out in two directions.

This resemblance to the letter R is curious and very strong. Even back to front, it demands attention. This reference to language can be seen in the whole collection as I remember it - it is like letters, like an alphabet. I can see a strong link to genetics and DNA not in terms of morphology but as a reductionist system of codes. Our understanding of DNA uses the letters of the genetic alphabet - C, G, U, and A. These letters, in various forms, code for proteins in such complex variations that they can account for the huge array of complex forms that all living organisms are. There's something analogous to DNA in this project – some sort of grey matter or rather the electric and chemical messages contained within. If we could reduce thought down and encode it perhaps we could develop a neat recipe like DNA. But like DNA, which contains what we currently think is piles of meaningless code, there are heaps of unrelated thoughts that bear no or little relation to the work at hand. Should I put this grey T-shirt with the black or coloured washing? Do I have enough change for the parking meter? The green or red apple in Oskar's lunch today? The minutiae of everyday life.



On another level, these strings of seemingly meaning code and the minutiae of an individual's life are important and like the flapping of the butterfly's wings somehow contribute to the bigger picture.

The shape of the R also reminds me of Russian Constructivism. The linear nature of the material produces a hard edged, geometric form with exaggerated angles.

Friday 5 August

OBJECT 19

Again there is a strong formal relationship with the last object but this object is smaller, reduced – a condensed version of the last. It has fewer lengths of tube and but is more focussed with a single end with protruding pins. This end is thicker, longer and more substantial. It has 37 small pins with one central longer thicker pin. (As I write, I am trying to ignore the fact that it seems quite phallic – like a two handed dildo.) It can sit upright rather than lying down like many of the previous objects. This projects the central tube with the pins out at an angle of about 60 degrees. The object has two handles which can be held in each hand – one steadies the object. It has the feeling of a weapon but whatever it propels, shoots up into the air and not directly in front of it. The direct formal relationship to the English alphabet seems lost in this object although it seems obvious now that this collection is constructing its own formal lexicon.

This object and the last were finished on the same day. What sort of effect does this proximity in construction have? Does it encourage mimicry or exert pressure for change? Or both or either depending on other conditions?…. How much control do I have?

Now that I have made nearly 20 objects, I am starting to feel a collective sense of them. While I can't remember exactly which one say, no. 14 was, I can feel the weight of past processes, of memory, of layers and of thought and action. This is not one object, one concept that has come into being in isolation. It has a whole family, a network of associations that come before and will go beyond it. Obviously all objects have histories, remembered or otherwise. These objects have histories that are being created purposefully. Why not just get rid of the objects at the end of the process? Their physicality is no longer required - it is the history, the story, the narrative that matters. Each object becomes subsumed by the broader picture. None exist in isolation.

Monday 8 August

OBJECT 20

Only a few days later, this has been a very active and productive time. The handle is still strongly present in this object but there are no longer pins coming out of the ends. Instead there are 4 tubes that come out from the sides of a larger central tube and then bend over and out to return to the top of the tube. With the handle retained again this object appears like a tool that is held in front of the body and acts upon something in front of it. It is like a robotic claw, a Mixmaster beater or an underwater propeller. Something that opens out or something that whirrs around, churns and propels liquids whether smooth or viscous. It is an active and transformative object. it. This idea of transformation is embedded within the object and is intrinsic to it even in its fixed, passive and mute state.

At this point in the project, after 20 objects, I'm aware of the layering effect of this type of production. The actual end point of the construction process is linear. Like a book, each object is produced one after the other just like the pages of a book and the history of these objects form a text that can be read. But like a text, different pages can refer to pages earlier and later in the book. And, like an archaeological site, pages don't make sense

if they aren't organised. Context is important and contributes to the meaning of the objects of this series. One of the objects on its own doesn't look like much. It needs to be read in relation to the narrative of the objects. These objects aren't literally buried as they might be in an archaeological site. Excavation of these sites involves destruction as each layer is removed. If we don't find a way to document and understand everything becomes a jumble, a pile of nonsensical rubbish.

I am beginning to feel the weight of the project - of all these little objects carefully made out of cardboard. The heaviness of the layering of memory, of all this looking back and of remembering and forgetting because at this point I've lost track in my mind's eye. After 20 objects I've lost track internally and it's hard to find a place in my mind to carefully order and remember them all…they just end up cluttering up the place I feel like they've all been internalised but all mixed up and in my mind have become some kind of homogenous lump.

Friday 19 August

OBJECT 21

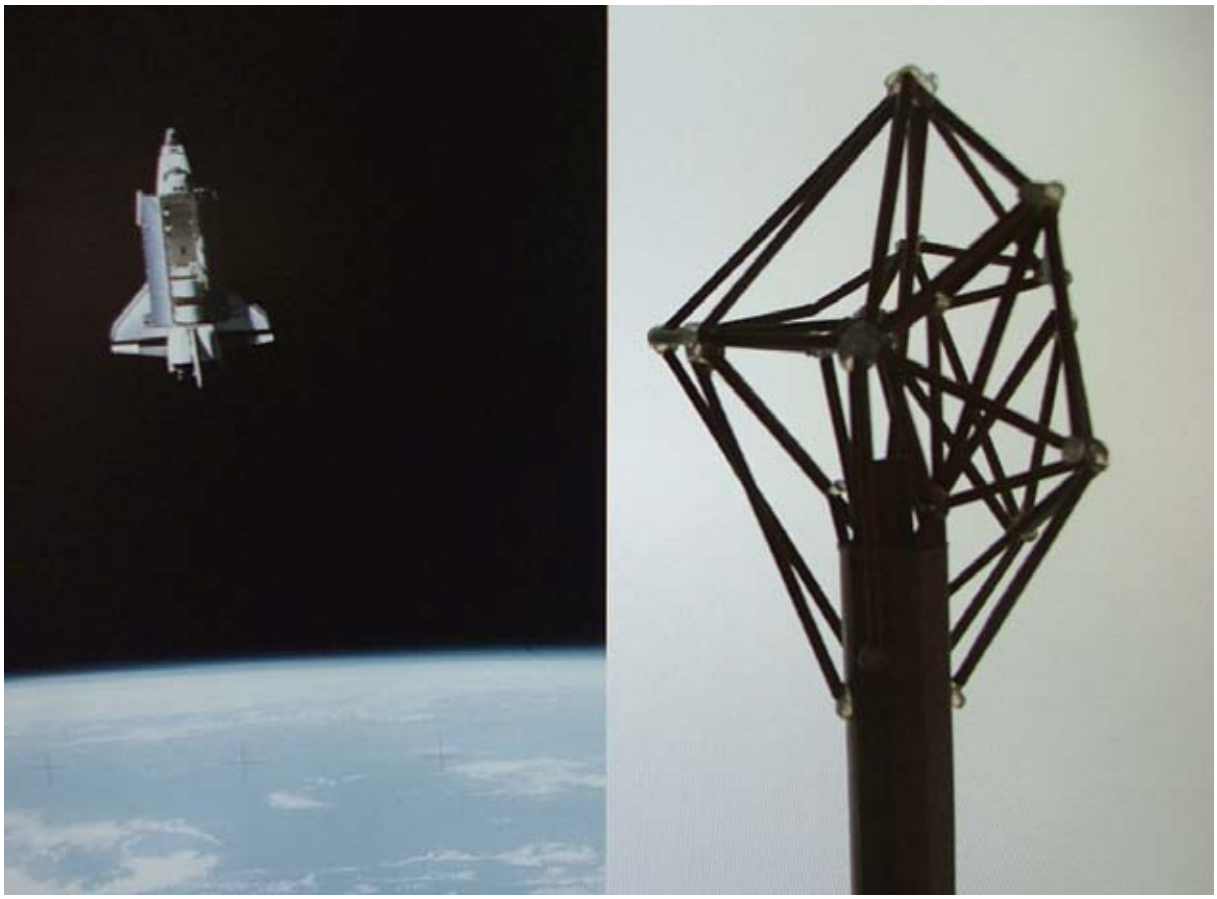
Apart from my recent ruminations, everything seemed to be making sense formally and moving along at a steady and reasonable pace. This object suddenly seems so different and left field and has thrown a spanner in the works. And of course I knew this as I was making it. I knew it was different and that I was trying something else, something new. I just don't have plans on where it could go. It's also taken a bit longer to make and there's been a break between it and the last object. Perhaps it is a transitional object purely 'designed' to take the objects from one state to another. An analogy to the step from water to land of the lobe finned fish? It holds a kind of tension for the project….almost wavering and not sure where to go next.

It reminds me of a couple of different things – a space shuttle, Tatlin's monument that I wrote an essay about once, something with a large faceted jewel on the end of it. It can stand independently in a vertical position. The handle and the extended prop are reminiscent of the other objects but the most divergent part is the

end which is composed of long rolled up brown paper tubes which are joined by uneven blobs of hot glue. This open form is a little like a lumpy Buckminster Fuller design – not quite a pleasingly harmonious geodesic dome.

It is also a framework, a skeleton of forms seen earlier in the series. It is revealing and holds no secrets in its form – no internal, invisible bracing with bamboo skewers like some of the objects have. It is a little ungracious for my liking. I'd prefer it to look effortless and neat. Instead I think the difficulty of the process is more apparent. My ability in the pursuit of this craft – the craft of hot glue and corrugated cardboard and brown water activated tape – comes into question. I think this is one of the limiting factors (selective pressures) of the project. As different methods are experimented with and 'fail' in particular ways, they are then avoided and maybe not seen again. My ability to manipulate the given materials in a particular way with particular outcomes needs to be maintained. I'm still finding out what this is because the only way to find out is by doing, by its own activity and in the moment.

I think I've said that before. This writing is starting to feel like some large macerated chunk of stuff that's getting chewed over and over and offering up some of the same flavours and textures again and again and again.



Friday 2 September

OBJECT 22

Something has changed and I'm not even sure if I want to go on writing. In fact, the writing ground to a halt some time ago and I've had to come back to complete it. I'm not sure if it's worth writing anything now that I know what happens next. Should I continue to try to write in the moment or should I just stop? I can't stop because I can't stand the idea or possibility that part of this project might remain incomplete. I want there to be the correct number of everything in the right order and in the right place. I know that this 'after the fact' writing doesn't quite fit in with this righteous enumeration but at least it is a transparent process. There is room for this admission and then the possibility of continuing and letting this just become another little nodal point in this particular history. Then it just becomes a question of perspective or positioning.

Like the previous object, I find myself at a point of rupture, not only formally but cognitively. At this point I can look both forwards and backwards. This disrupts the linear nature of the process and mirrors the conceptual process where fragments of past objects persist and whole objects are forgotten for no particular reason. Like any other complex system this state of flux is productive even if it's confusing to be inside the process.

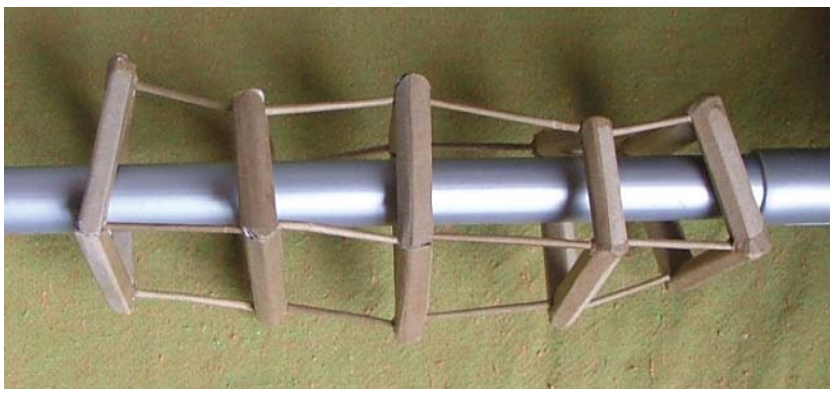
Somehow this is reflected in this object. It has a certain lightness – like a cloud or puff of smoke. It's also like a model of a molecule and with parts floating in solution. It is composed of 21 short corrugated cardboard tubes which are connected to each other by a framework of tightly rolled brown tape tubes. This framework connects to the larger tubes through their open ends as well as by piercing the sides of the tubes. Angles and lengths are unequal. It has a kind of naïve arkwardness. It has a strong relationship to part of the previous object. It is like an expanded section of it, an enlargement, a narrowing in or a close-up. Other parts of the previous object are discarded – the 'handle', the central tube.

This object hangs in the air, suspended, stuck, in slow motion. It is in the middle more or less, waiting, hovering, wondering what will happen next.

Monday 5 September

OBJECT 23

Another bump in the evolutionary road of the project. Another example that changes will not necessarily happen smoothly, evenly and make sense. I guess I am punctuating my own equilibria. So instead of the nice, gradual and continuous change (phyletic gradualism) that Darwin more or less proposed, I am creating my own revolutionary transitions. Transitions where my objects can take massive structural leaps and be replaced by wholly new forms. These new forms are still related to previous forms, often utilising little features of each object to make great lateral formal leaps.



There is a thematic opening up, unfolding as

the objects become open forms. There is both a trapping of air and an open exchange between interior and exterior. Or this air can be pushed and pulled out of spaces like an accordian. Or contained like an eel in an eel trap. In such open and transparent conditions the 'eel' is not imprisoned but framed and viewed by this device which has the capacity to capture it from a number of different perspectives.

This object is most simply described as a series of polygons. These polygons are four sided. At least two of them are regular enough to be called squares. The other three have sides of unequal lengths. These polygons are joined by long thin tubes of brown tape. One of the polygons is larger than the others and pushes the framework out, bulging like a snake that has engulfed something rather large for lunch. Our gut, like many other animals, is reminiscent of the worm structure. It is long and convoluted and connected to other organs but in essence is a tube which has two openings and is designed to process and transform matter. The unprocessed matter enters at the front and is expelled at the back. It's important that the organism moves forward in the direction that the mouth faces so that it continues to seek sustenance but moves away from it's excrement and leaves it behind. (Someone did a big poo next to my car today. It was parked next to a cold and deserted playground and when I came back there was a large pile of poo and some toilet paper right next to it near the rear passenger door. At first I thought it was dog poo….The processing organism had moved on and I'm just glad I didn't walk in it.)

Friday 9 September

OBJECT 24

This object is like a mutated shard of the previous one. It is constructed of thicker tubes and has a heavier feel. At its centre is an irregular polygon from which 11 tubes extend at oblique angles. The ends of these tubes are open and I can see the rolled corrugations of the cardboard inside as well as a trace of white printing on its internal face. It's as if this object is feeling around itself, groping around, possibly in the dark, testing limits by using these open extensions to suck up samples of its environment – to observe, taste, feel - stretching outwards in all directions like an underwater creature.

If this was a mutation, it would be a massive change. Massive mutations in real life are generally unsustainable. Change occurs at the level of the DNA sequence with an alteration in the sequence of nucleotides. Even small alterations can make big changes. This could happen to a written instruction that must be followed to make one of these objects. An experimenter could write a series of instructions to be followed to make an object. These instructions would be passed on to the subject to make the object. Once made, the instructions would be destroyed and the subject would be asked to rewrite the instructions using both the memory of the original instructions and the memory of actually constructing the object. In this way both the genotype and phenotype would change as each new subject receives the instructions and creates the object.

The phenotype alone could be used as a reference point in a similar process. The aim would be to keep making the same object over and over but only in reference to the previous object. I assume that subtle change would occur and be carried over even if great care was taken to create exactly the same object. A control object could be created by constructing the same object repeatedly by referring to the original object rather than referring to each previous object as they are constructed..

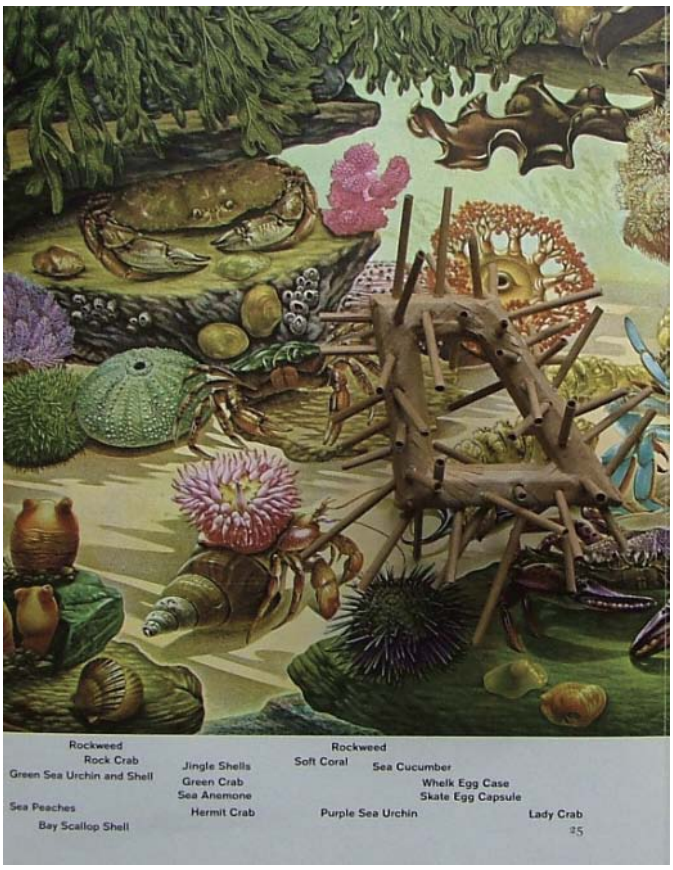
Saturday 10 September

OBJECT 25

This object is an exaggeration of its predecessor. It is bigger, its tubes are thicker and there are more of them. At its centre is a five sided irregular polygon with 23 tubes branching off it. Most of these extend at oblique angles but a few are more or less perpendicular to the central structure.The ends of the tubes are again open and porous but there is also a hint of pink on the internal rolls of the cardboard.The cardboard I've used to create these objects is predominately from the boxes that reams of A4 paper are transported in and is sourced from the library or copy centre. At the copy centre, they changed to a new brand of paper in a bright pink and white box. Coincidentally it is called EVOLVE. On their web site they suggest that we "make the leap to evolve today" with the picture of a frog. It is such a good source of cardboard and it seems serendipitous. I like this idea of the accidental. Chance or random genetic drift is an important notion in evolution even if it is then directed by selective environmental forces. It is also important as an artist, especially in a project such as this which is at times very prescribed and restrictive. As an artist, it is important to pick up on the little things that may not get noticed, that are unimportant and take them on, nuture them, understand them and then know when to let them be when they are no longer relevant.

Saturday 10 September

OBJECT 26



This object is a variation on a theme but expressed in a different way. Again if we use the DNA metaphor we are looking at a change at the level of the genotype which is expressed in the phenotypic appearance. The genotype of the project is not expressed as a series of nucleotide bases that code for particular proteins but instead as a series of thoughts or even chemical and electrical impulses deep within the brain that cannot be codified or enumerated in the same way DNA sequences can be. Thinking is a much more fluid, immeasurable biological activity, irreducible to a series of letters or numbers. Disciplines interested in these ideas, such as evolutionary epistemology or evolutionary psychology, summarise evolution as a process of blind variation and selective retention (BVSR) and theorise thinking not only as operating in this way but also as an outcome of this process in a biological sense. A bit like the chicken and egg idea.

This idea of blind variation is very important in evolution especially in

arguments against creationism or the idea of an overall 'designer' of nature. But what I like about this idea is that not only does evolution not necessarily produce the absolute 'best' of anything – really it's more like it produces organisms of the 'best fit' for particular conditions in a particular time and place. If conditions were different, the outcomes would be different but not necessarily better or worse – just different. When I consider the choices I could or have made in my project I feel nervous – perhaps my forms would be 'better' at object 'c' if I'd developed a different method or style. However, as it stands all the choices are 'good enough' – they don't need to be 'brilliant' and really we have no way of knowing what brilliant is especially when it involves incredibly subjective thinking. What is most important is the overall project, the multitude, the array.

This object is diminutive. The objects currently have oscillating dimensions – big, small, big, small…. This object is at least half the size of its predecessor. It is structurally similar but materially different. The central structure has reverted back to a four sided irregular polygon. This time rather than having the standard tubes attached to this structure, it has the brown rolled tape tiny tubes piercing it and radiating out in all directions. It is like an echinoderm – a spiky sea creature - like a sea urchin. As I mentioned earlier, this form is a variation on a theme. The last few objects have been very similar structurally and the project has become a kind of exploration of this rather than a more obvious evolution of form.

Wednesday 21 October

OBJECT 27

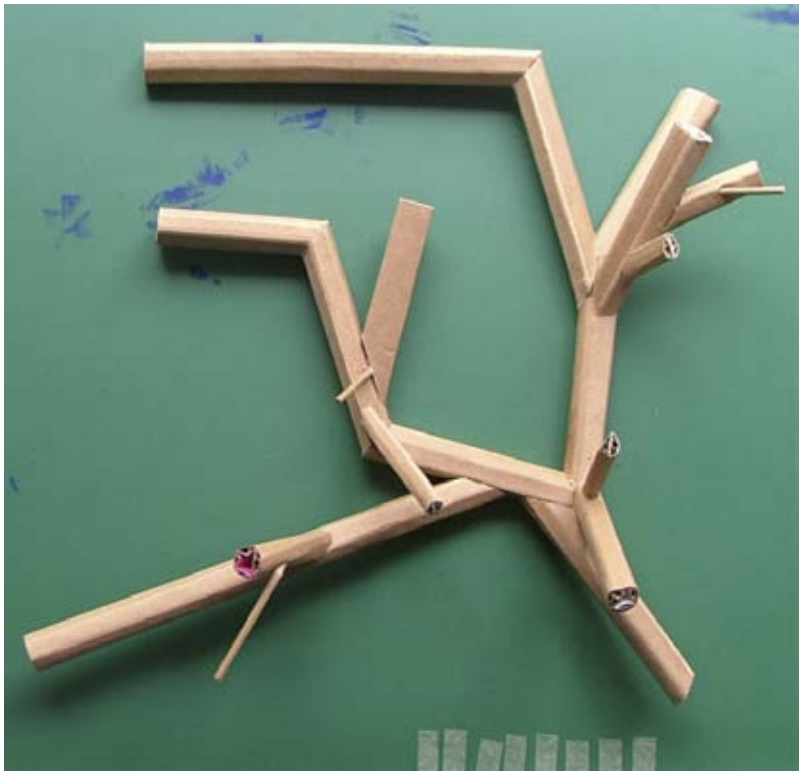
This object is not really like the others before it – it doesn't belong in the particular subset that was evolving. It is obviously related and retains the irregular polygon as a part, although it is no longer the structural centre of the object. It is at one end and then rather than each tube beginning attached to the polygon, they attach to each other bending and spreading in oblique directions. There is also a remanent of the multitude of brown tape tubes that pierced and covered the previous object. There are now only seven of these and they look like little whiskers on a blind worm-like animal that lives underground. They act like probes or proboscis helping it to independently navigate over various surfaces.

I don't know why I haven't thought about the notion of artificial selection before but obviously this project falls into that category metaphorically too. I remember vividly the section about this in my Time Life book on evolution I had as a kid. There's a great diagram in it about the genealogy of the dog as well as some fantastic pictures of giant Japanese vegetables and a range of multicoloured roses. At times during the project I have actively tried to rid the objects of something that I found annoying to make or was too time consuming or too difficult or not suited to the materials used. I have made myself artificial boundaries – why not other materials, time restrictions, basic size. All these decisions have affected the outcomes and all have been self imposed.

Wednesday 21 October

OBJECT 28

Now the objects are becoming less bounded, more diffuse, spreading and expanding. They are ground hugging and flat like a grass runner – like the buffalo grass my Mother planted in the garden of the new house in Townsville which spread like mad to cover the ground in a lush, green carpet. The rhizomic structure of this horizontal spreading root can be broken into pieces and still grow and spread. There is no beginning and no end. There is a 'middle' which can endlessly replicate itself. This object has no real focal point, resembles nothing in particular (apart from grass) and finds itself somewhere in the middle of this project depending on how the endpoint is defined. It speaks more of the production process than its resemblances by heading on in at least 20 different directions. There is a vestige of an aborescent or tree shaped structure. The form could be described as centred around a central tube from which it branches out and from which smaller branches are produced.

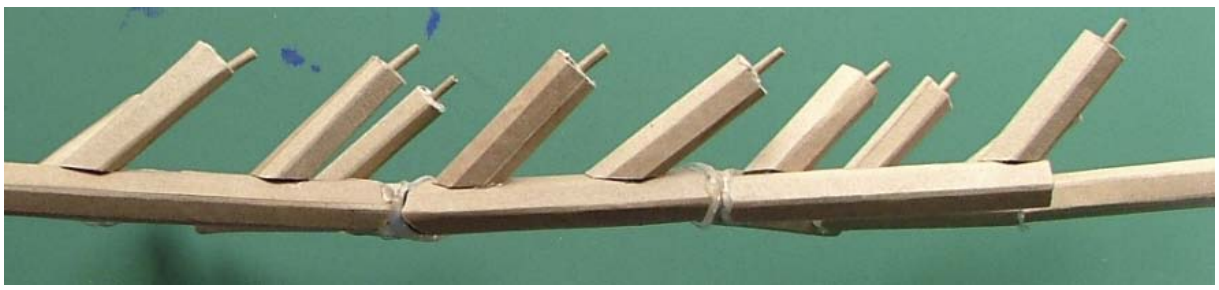


Wednesday 21 October

OBJECT 29

This is a rapidly occurring sequence of objects as the two previous objects and this one were all constructed on the same day. This accounts for the obvious similarities especially between this one and the last. They are very similar in basic structure although the form is slightly different. This object really is much more rhizomic with no central branching points - it looks like it may have been cut out of the middle of some other structure. Aside from this difference, each of its processes or tubular projections is open but contains a tiny tube of rolled brown tape in its end. It provides a hint of further growth but always in the same direction as the tube. Like some of the earlier objects and the previous one, these projections occur at oblique angles. I want to write more about what this object looks like but it resembles very little.

I'm drawn to reflect on the process of the project again and my attempts to make a tightly structured project and how these constraints have both frustrated and sustained me. Considering how long this project is taking to complete and the distractions of the births of my daughters, it is no coincidence that I chose create work with such a strong underlying backbone that it could be put down and picked up again enduring the discontinuity



of weeks/months or even a year away from it. Also it is a project that involves the construction of objects that really could be made anywhere - only requiring a flat surface and a power point. Consequently these objects have been made in various places – my studio at RMIT, the kitchen table and my little studio at the back of the house. This 'studio' is part of the lean to built by the previous owners so you don't need to go outside to go to the toilet. It's a small room with a ridiculously low ceiling situated between the bathroom and toilet. So I receive various visitors on the way to relieve themselves and since my computer is right outside the toilet door sometimes it's a good time to have a quick look around the garden or make a cup of tea until the air clears.

In a way the project, while an escape from the domestic, mirrors it in its repetitive nature. At times I feel so bored making yet another object using the same material and process. But it's a bit like cooking, the more immersed you become, the more interesting it becomes. As long as you don't make pasta napoli every night, it can be a very inventive and sustaining practice.

Thursday 22 October

OBJECT 30

Whenever I start to become comfortable with where the project is going, it takes a turn and changes and I have to re-align my thinking in order to keep up. This is a good thing – I'm forced to 'make first, think later'. While this object is formally similar to the last in the way it hugs the ground and is root like, there is one major difference in its construction. It is made up of segments and each one of these segments is more or less exactly the same. Each one is just over a centimetre long and they are joined together with a continuous string of hot glue on the outside that goes around the join to form a transparent ring.

This modular strategy is mirrored in the body plans of many animals and plants. Most obvious are the segmented worms (annelids), of which the earthworm is the most common, and the arthropods (insects, crustaceans and arachnids). Some of these organisms are less regularly segmented than the worm and some have parts that are segmented. Our own bodies have segmented parts that are less obvious such as the vertebral column. But the segmented worms interest me most – each segment not only is repetitive in terms of external form but also internal structure. Many body parts are repeated within segments including reproductive organs. Even if part of the body is damaged or lost the worm can still function. This is what makes these organisms so successful in an evolutionary sense.

In terms of process, particularly my process, these modular parts do provide a certain systematic flexibility. They allow me to quickly produce a large number of smaller segments that can be arranged in various differing ways to create a range of structures. There are limiting factors but just like the limitations of this project, it's working inside the parameters that enables creativity. This argument always brings Shakespeare's sonnets to mind. There are 154 sonnets and nearly all of them are based on the same 14 line structure - three four line stanzas and a final couplet (abab cdcd efef gg). Over and over again, this form can be used to produce many different sonnets. Similarly the parameters of this project, could be used to produce many more objects and the forms produced by the act of producing each object could be explored further. This is just the tip of the iceberg…

Wednesday 28 October

OBJECT 31

This object is similar to the last. It is made up of repeating segments that are all identical – there are 51 in total. Again it is a ground hugging structure that is parallel to the orienting surface. It has five processes that extend upwards and outwards. Each is constructed out of two segments. It is not as tall as its predecessor and spreads out more and is less compact. Again it has loops of hot glue which surround the site of each join and exaggerate and embellish the segmentation. The vertical ends of the object are glue filled and catch the light. The segments ending on horizontal parts are open and empty. Each row of segments is straight and longer and each meets the other directly and at a perpendicular angle. There is a sense of a grid, an allusion to architecture, to planning and the model.

I like the tension in these objects as they oscillate been the actual and representation. Are they models and as such defined as hypothetical descriptions of a complex entity or process? And is the whole project an example of modelling where this series of objects is used to simulate and predict? Are they an imprint or remanent or trace or transfer of information from one kind of matter to another? That is, for example, an effect of their materiality translated from a series of neurological impulses. A material fossil is often made up of a substitute material – a material that is only relevant because of its ability to absorb and reproduce the imprint of a living organism. The imprint of this organism becomes a representation of the original but has a totally different chemical composition. It becomes inert as this is the very property that ensures the longevity of the original form. In this way, a range of biological material is homogenised. The heterogeneous becomes the homogenous.

In the project there is a similar translation from a wide range of stimuli to a comparatively inert yet receptive material. This is why an unwavering commitment to the materials used is necessary. It's tempting to add something else, to make it more expressive and interesting. But this would incur a loss, make it less translatable, muddy the waters…

Thursday 29 October

OBJECT 32

Another small alteration – a return to phyletic gradualism. Now that I've made over 30 objects, I can begin to uncover a cycling that the project goes through. At first there were four or five objects that made initial explorations of material and structure, then a consolidated period of gradual change , then this equilibrium was disrupted by a series of quite revolutionary objects and now we have settled back to an even more relaxed era where minor changes keep the basic structure intact. Still there is a disruption caused by this object which could easily be missed in a photograph. It's not major but the kind of change that could take the series off into another direction.

This object is made of the same segments as the last few objects. The central structure is composed of 6 more or less linear lengths. The shortest is 4 segments long. The longest is 11 segments long. On one side there are 8 protrusions attached perpendicularly to the central structure. Each linear length has at least one of these attached. These attached sections are all composed of a single segments and the exposed ends are glue filled. On the other side are 4 more attachments, each also of one segment. Each linear length has an attachment except for the longest. They are also glue filled. The object retains its planar orientation but it is elevated and lifted off the ground by these 'feet'. Like a stick insect or other camouflaged Phasmid it might quietly scuttle off or just sit quietly in a pile of discarded cardboard and not be noticed at all. Lurking and moving very little….

Thursday 29 October

OBJECT 33

Oskar has this fascination with ants at the moment and is constantly musing about scale and how ants might relate to an object the size of our fridge. To an ant, it would be like a skyscraper says Oskar. Tonight we were talking about why there aren't giant insects even if they sometimes appear in scary movies. (There is a 1950's movie called "Them" which is about giant ant like insects produced by nuclear tests in the New Mexico desert.) We were discussing why really big insects aren't plausible. While insects are hugely evolutionarily successful, they have a keratinised exoskeleton rather than the calciferous internal skeleton we have. Structurally it's just not strong enough to be bigger. The ratio of surface area to body volume is also an issue. We have quite a small surface area to volume ratio and this necessitates specialised internal organs. Many smaller organisms have a much greater surface area and don't need large organs for oxygen uptake, for example, because they can use body surface for gaseous exchange. We need lungs to create large internal surface areas so that we can breathe.

All of the objects I've constructed so far are of a similar size and scale. Partly this is because of the site of construction and my body position – seated at a desk or table. But also the materials, processes and methods just aren't suited to creating bigger objects. Some of the objects I've already made have needed internal strengthening – usually a wooden skewer to help strengthen the joins between the tubes. These current objects constructed of 1cm segments are quite strong but are still limited.

This object is an exaggeration of the last, an extension of the idea, creating a structure that is less horizontal, more vertical but also less stable. The main structure is now decentralised and is made up of fewer segments than the vertical sections. Each vertical section is made up of four segments and there are four of these on either side of the central section. These longer extensions are even more like stick insect legs – too long proportionately for the rest of the form. Oskar, who is one of the 'Bug Masters' in the school playground, informs me that stick insects are one of the longest insects in the world and can grow up to about 33cm. (They also run a 'Bug Hospital' for injured insects – mysteriously missing legs usually.) These insects are also parthenogenetic which means they produce an egg that develops without fertilisation. There is natural variation in the genetic material in the eggs so the offspring aren't clones. Some stick insect species are all female – males just aren't necessary.

What's really new about this object is the way the hot glue has been applied to the vertical processes. Each one is covered in delicate lines of hot glue running along the lengths of the segmented tubes. These lines are slightly blobby and uneven and some are filled with tiny air bubbles. All this transparent glue catches the light and has a certain beauty. I wonder why it's taken me so long to think of applying the glue in this way?

Thursday 29 October

OBJECT 34

After the last object lifted itself up like a startled stick insect, this one has flattened out again. It is still primarily composed of segments of cut tubes glued together. There are four long tubes, three are made up of 13 segments, one is made up of 12. The lengths of these tubes are again covered in continuous lines of hot glue. There are about 11 running the length of each segmented tube. Because of the nature of the segments, their uneven lengths and wonky joins, the tubes are not straight, each one bends slightly, leans, some in more than one direction. These tubes are joined by four little square edged tubes which are smooth with no surface embellishments and about 1.5 – 2cm long. Two of the long tubes are joined by two of these square tubes, the others are joined by only one. It is not rigid and the object has some flex where these square tubes join. It can rotate slightly at these points due to the internal wooden skewer. This just makes it feel a bit tentative. It is supposed to do this or is it just shoddy work?

The object lies flat and inert. It doesn't have the life of the last few objects. This part of the cycle is one of inertness and the object really appears to be in an in-between or immature state. It feels a bit like I didn't finish making it, that there was some plan for finishing for it and turning it into a more fully three dimensional object. It is transitional. Aren't all of these objects transitional? - isn't that the point?

Friday 18 November

OBJECT 35

This object is made up of linear lengths of joined segments that are very similar to the previous object. The lengths are slightly shorter and all are constructed of ten segments of tube. They are all covered in fine, continuous lines of hot glue – each one has approximately eight or nine of these lines. There are seven lengths in total. The ends are open and at each end a tube of rolled brown tape has been inserted. These tubes are slightly fatter than the usual tiny tubes and only a short length protrudes from the end of each length. The lengths are joined together along their long sides and one of them is in the centre and is in contact with all the other tubes.

It looks just like a little bundle of sticks glued together.

Most obviously this object reminds me of a cocoon. It's a neat little metaphor really – METAMORPHOSIS – going through major formal and structural changes during development. Why didn't I think of this before? The series has been through a range of immature forms which have used certain resources. Now a pupa is forming – a rest phase, condensing, concealing and developing into something potentially very different. Metamorphosis is a strategy for using resources of a particular environment in the most efficient way by producing different forms with different needs. Just like a big fat caterpillar that hangs about gorging itself only moving along to munch on the next luscious leaf, the objects in this project have been consuming every available resource.

This object isn't quite at the stage of concealing its interior. It's still visible or at least the way the structure is put together is obvious and it's obvious that's there's nothing inside. Maybe those little rolled tubes at the end refer to possible interior growth? And the lines of glue now remind me of some kind of secretion that's sticky and is used for putting together these cocoons. So will the project now pupate, rest and emerge transformed?

Friday 18 November

OBJECT 36

This object is even more like a cocoon – the ones that are literally made of a bunch of twigs stuck together. It is very regular however with all the tubes parallel. The major change from the previous object is that the tubes are continuous and made of one tube of rolled cardboard. The segments are absent as are the continuous lines of glue. It appears, in comparison, more manufactured and less hand made with less variations in each tube. Still there is much variation between the tubes. They are of various diameters and there are 2 long thin tubes of rolled brown tape. All the tubes except for these have a tiny tube of rolled brown tape peeping out of the end. They are all different lengths so these ends are staggered and break up the form.

It is nice to hold this object in my hand. Its surface is smooth and it fits neatly and comfortably into my palm. It is neat and finished and contained. It appears to have an interior although on closer inspection, it's obvious the tubes are continuous. It's an almost crystalline structure – like basalt columns made of extruded volcanic rock. This kind of rock structure itself is metamorphic and illustrates a process that the land has experienced – of hot larva flowing and cooling and contracting rapidly to create a cellular

network when viewed from above. You can see this in the object too although the process of extrusion is quite different to the process of rolling.

It's also like a firecracker or stick of dynamite with lots of little wicks to ignite. It's just the right size to throw and then KAPOOW the project is up in smoke! I am concerned that my work could easily go up in flames or get wet. If it got wet it would just collapse and literally unwind. And snails are a concern too. My studio has grass growing into it and the slugs often come up through cracks in the concrete. There's been the odd nibble on cardboard boxes. They'd have a feast on the objects if they weren't stored in zip lock bags.

Friday 18 November

OBJECT 37

The segments have returned to the ends of this object. This is genetically possible – the trait becomes recessive and the right combination of genes will bring it back to the phenotype. This object is still constructed out of a series of tubes radially composed around a central tube – there are seven in total. It is of very similar dimensions to the last couple of objects – still fitting neatly in my hand. The segmented parts are on the ends of the tubes. Each end has four segments. These segments are more variable in size and are cut on an angle rather than being straight edged. Consequently, the ends splay out from the more centralised tubes. This gives the object some life – you could hold it in your hand and squeeze it and watch the ends squirm and writhe. (I could make a nice little animated video by turning the object in my hand so it appears the ends are moving.) The tube in the very middle doesn't have any segments attached – it acts as a purely structural device.

A subtle, yet important difference is that the ends of the tubes are covered by a small circle of brown tape. These circles fit on satisfyingly neatly. Each tube is then seemingly self contained and closed. Aesthetically it's a nice finish – slightly rough and hand made but very consistent with some evidence of dexterity. The object is smooth but there is some evidence of hot glue between the parts. I wonder how these objects would change if they were made from wood (cut up pieces of dowel) and all the cracks were filled and sanded – the object would be more continuous, more homogenous, less transitional, more or less like a model. I wish I had time to try it right now. I originally thought I could have lots of different strands and make many different objects but the reality is that I need to keep the project on track, contain it and not let it get too diffuse and lose focus by doing lots of little bits and pieces. I really need to be very disciplined to stick to the project and make, write, document, photograph as well as keeping it all under control on the computer so I can find everything. And what is the output – the objects or the associated products. Obviously both but I have to draw the line somewhere….

Saturday 19 November

OBJECT 38

This time, the segmented ends have been retained and the central part has changed radically. It is now a single rectilinear box. It is much longer (about 40 cm) but not very thick (about1cm). The top and bottom of this central box has a piece of brown tape running along the lengths. Connected to this, the segmented parts (at each end there are four, each made up of four unevenly cut segments) are like appendages. They resemble the legs of a crab or spider – there is the potential that the object could run off sideways. They even look a little

like fingers because of the jointed appearance of the segments. I get a strange feeling from this corporeal resemblance – like someone or something is trapped or set in stone like a statue and can't escape. Actually I feel quite frustrated that these things can't actually move or do anything. It would be interesting if they could even if it was just a single action. The 'fingers' could curl and uncurl for example. Some of this could be screen mediated but to see the actual, the object, do it would be immensely satisfying.

The length of the central form is interesting – it is extended, stretched, extruded, pulled. It is rectilinear and there are very few examples of this in the project. The tube is the dominant form of the objects. The tubes are formed by rolling the cardboard tightly, holding it in place with hot glue and then sealing the join with brown tape. Straight sided objects can also be made using a similar method but they are not as strong and need internal bracing. Still am I working primarily with the tube because this is what the material is best suited to or is it just what I've chosen to use? Am I driving the project or is it driving me?

Saturday 19 November

OBJECT 39

The objects are reminding me of micro organisms again – three dimensional models of them. The segmented appendages are cilia – like little hairs that help these organisms to move. If they were longer in relation to the size of the main body they would be flagella which are more whip like. I used to love drawing all the diagrams of these. There are also some fantastic cellular structures in eukaryotic cells (which make up all living organisms except for bacteria and blue green algae). These are great to draw and have interesting names like the endoplasmic reticulum (involved in protein folding and with a membranous folded structure itself) and the golgi apparatus (named after Mr Golgi).

This object now has a series of appendages along its upper surface as well as at the two ends of the central structure. These appendages have their ends enclosed with the neat little brown tape circles seen in the previous object. The central structure is slightly shorter and the edges follow the corrugations of the cardboard and bend to make a flattened ovoid shape. Along the flattened top are nine appendages, each made up of four segments, that all bend slightly in different directions. They look like they're bending in response to some kind of stimuli – each in different ways. They display tropism. There are now only two appendages at each end of the central structure. The object has only one real orientation. If it is placed to rest on either side it looks like it has fallen over and it can't balance on its reverse side. It is a bit top heavy and hard to hold as it keeps flopping over. This kind of structure, while interesting, seems unsustainable.

This is another one of those objects that has a very strong transitional feel. I've come to realise that the objects I feel least comfortable with are often on their way to becoming something more interesting. The great freedom of this project is the ability to make objects that don't quite feel right but to let them exist and just be. This allows other things to develop. This object is just one small part of a bigger picture.

Friday 25 November

OBJECT 40

If I continue to use the metaphor of metamorphosis as part of the evolutionary development of the series, this object would be a mature form. It has retained the rectilinear central structure but it now is even on all sides like a square tube. It has a series of appendages which dominate the form. There are twelve on each side of the square tube; each constructed of four segments as in the previous object. At each end of the object are two appendages made of three segments. These are more like probes than the others which seem more involved in motility. This object is double ended – same at the front and back as well as being bilaterally symmetrical –a mirror image of itself down the centre. We are bilaterally symmetrical – two eyes, ears, arms and legs on opposing sides of our bodies. Our head and bottom ends are different of course. The object seems to have an upper side and under side too. If you turn it over, it's like a beetle on its back with all its legs waving in the air. The legs and the concentration of them is very satisfying – a critical mass of legs. The amount of energy required to keep them all going from a smaller body seems almost impossible.

Sometimes I wonder when I look a an object like this "Where can I go from here?" Probably in a number of different directions each as valid as the other. Really right now I just want to go and watch TV and forget about all this for a bit. It is both annoying and consuming and fantastic to have a project like this with such longevity despite all the interruptions. The fractured nature of the project was planned so it could be broken up into parts to be picked up and put down again. Sometimes I work on it in great bursts and sometimes it's just little bits here and there. The project manages to contain all this fragmented activity in a meaningful and wholistic way.

Friday 25 November

OBJECT 41

This object also has a feeling of completeness and maturity. It has twelve appendages extending from a central structure. There are now fewer segments in these appendages and the central structure is quite different. There is a concealed bamboo skewer that runs through the centre of the object giving it internal strength. Externally, the skewer is covered in brown tape and this brown tape is only visible in the sections between each appendage. The skewer runs through and joins twelve 'C' shaped tubular structures each made of five segments. The segments are all slightly different in length and shape so there is variation in the direction that the ends take – some curl under slightly, others have a more open shape. While the structural plan appears very similar to the last object, it is radically different in its expression. Instead of 24 separate appendages, there are now twelve continuous parts that curve to form 24 ends. The central structure is now smaller and lighter and pierces the interior spaces of the appendages.

Somehow it's both very similar and very different. It is closely related and both objects were made on the same day. This issue is somewhat like the idea of 'convergence' in biology. Organisms can have very similar, analogous structures but not be genetically closely related. A good example is wings shared by butterflies and birds, which are very different genetically although they have a similar structure and purpose. Temporally my objects are very closely related but conceptually there is a small leap…

The flip side of this is the homologous structure which can be found on seemingly distantly related organisms. These structures show that some features can be shared by related but different species. A good example is the bones of a whale fin and the bones in a human arm. These bones are very similar and point to common ancestors.

This object is all legs and reminds me of a centipede. Perhaps the appendages or extensions could be mark making like thick pieces of chalk or a tool for marking rows in soil for planting very small seeds. Each appendage has a purpose – a reason for existence.

Friday 9 December

OBJECT 42

This object was made two weeks after the last object and is almost identical. It is exactly the same length and has the same number of parts and identical structure. The main difference is that the ends of the twelve 'appendages' are now curling over and almost meeting. The tension in this movement is almost palpable and looking at the two objects together I can imagine them curling up and contracting and then springing open again. They look much more like fingers again. The segments look like joints and the paper covered ends like neatly trimmed fingernails. It's also like a rib cage curving around to contain a body long gone.

While the internal spine is continuous, externally it appears segmented and broken into pieces. It appears much more flexible than it really is – as though it could bend over on itself.

Each little finger also has its own individual characteristics. They are facing in different directions – towards and away from other fingers. It's like a community of smaller objects or parts that have come together for a purpose – to create a colony. The project is a community of objects, a colony, and these objects mutually benefit by coming together.

Friday 20 January

OBJECT43

By this point in the project, I'm not surprised by anything. As long as the object is constructed from rolled corrugated cardboard and brown tape and hot glue it is welcome to be part of the group.

This object is segmented and made up of 38 tubular sections. At one end, one of these sections is 11cm – much longer in comparison to the others. The other 37 range in size from about 1.5cm to about 4cm. The ends of these tubes are cut at oblique angles and the object forms tight loops that turn into spirals. There are 4 complete loops. It is difficult to work out where one ends and the next begins. As soon as I started writing, the word spiral brought the double heliced structure of DNA to mind. I could make a nice DNA model out of my materials. But this object isn't a regular double helix at all. It's more irregular - like a rouge protein or even a prion (proteinaceous infectious particle). Prions are really interesting not only because of the neurological diseases they cause which are all fatal and currently untreatable, but because they are purely made up of protein. All living organisms have nucleic acid as well as proteins so they can reproduce. Prions, therefore, are not really considered to be alive yet they have evolved to be spread and cause a number of particular and identifiable illnesses. Until we could understand this, we couldn't begin to work out what these disease states were, let alone treat them. At least we were able to open up our frame of understanding of what can cause disease enough to believe that such a thing as a prion could exist.

The best known prion caused disease state is Creutzfeldt-Jakob which has been spread through blood products in Australia. I also remember reading an article in the Good Weekend about Fatal Familial Insomnia. I'm not sure if death is caused by the lack of sleep or is directly due to the effects of the prion in the brain. Prions kill off brain cells and the brain becomes spongy – it literally develops holes. The technical term is SPONGIFORM. I first heard about prions in a virology lecture. We studied what was then termed a 'slow virus' that caused Kuru. Kuru was prevalent in Paupa New Guinea about 50 years ago and was spread by the funereal practice of eating the brain of the deceased. In evolutionary terms this is a particularly novel adaptation. Kuru takes a long time to develop – and it took a long time to discover the agent and its mode of transmission.

The object is less representational than many of the others, less easily defined, more abstract - like a prion. It is like a representation of a process or movement, a trail of action of something that takes a run up and then spins like an ice skater. Or like a plant that has been trained to grow around an object that has later been removed. It traces the form of this object by grabbing on to it and growing over it – like a fossil, the form is represented in an alternative matter.

Tuesday 24 January

OBJECT 44

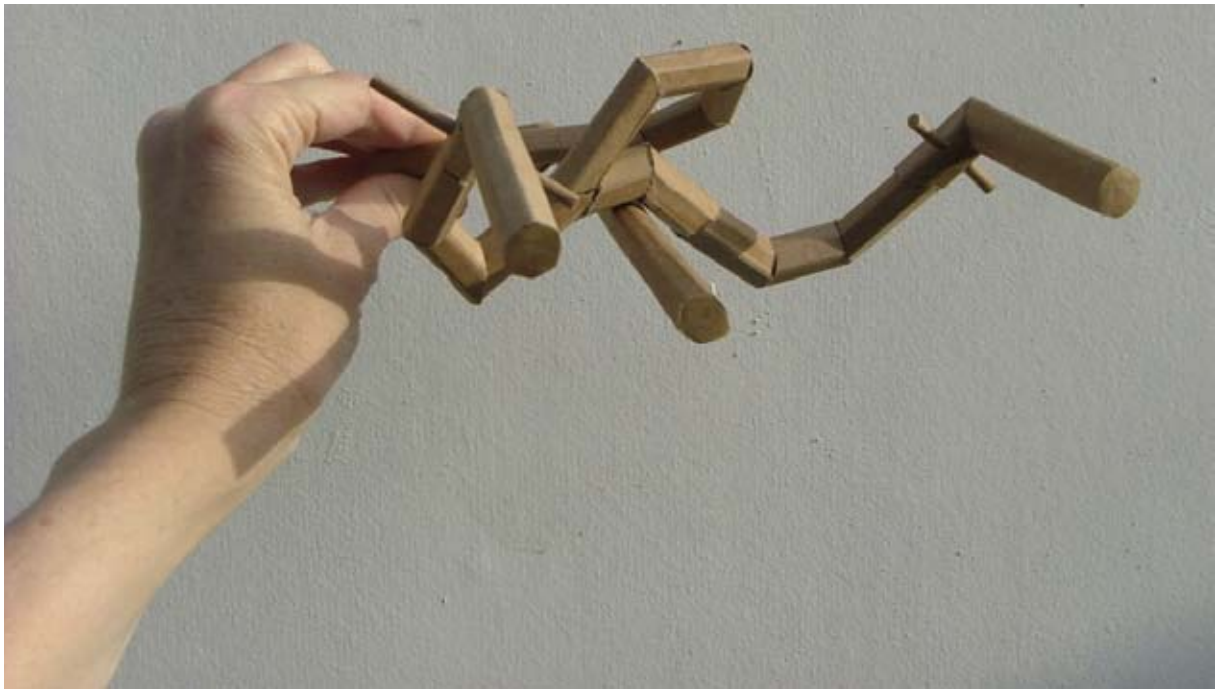
This object is similar to the last - it has just unwound slightly. There are no tight loops in the structure but it has approximately the same number of segments. The segments are of similar size and shape – cut obliquely so the object can twist and loop around itself. It contains itself and finds the shape of itself as it travels through the spaces of its own form. At either end of the object is a longer tube – its predecessor only had a longer tube at one end. One tube is approximately 12cm, the other 20cm. In the segment next to the 12cm tube is an intersecting brown tape tube that extends about 1.5cm out of each side. This little tube of about 3mm in diameter has tiny 3mm diameter circles of brown tape covering the ends. This part of the object is elevated and rising like the head of a snake charmer's snake. The little extending tubes and circles are like curious tube eyes that promote vision of objects to the side. At the front is the long tube like snout. This creature finds its way via an enhanced sense of smell like a little mole. The rest of its body is coiled behind it and moves through itself as it locomotes.

I haven't noted this elsewhere but in some of these objects, especially the segmented ones, the cardboard tubes appear to be different colours. This is due to the position of the brown tape that holds all of the tubes together. It is slightly darker than the cardboard which has some slight variations. The tape is quite homogenous in colour and texture. On some of the objects, these parts alternate so the contrast is more obvious and it produces a striped visual effect.

Friday 27 January

OBJECT 45

This object has three ends. There is a 'Y' shaped branching-off point that is approximately in the central part of the object. One of the ends has a longer tube of about 14.5cm. The other ends are about half the length at 7.5cm each. There is one loop in the structure but the whole object is shorter as it has fewer segments than the last object – about 26. While it can't stand on them, the three ends are like legs and suggest the possibility of balance – a tripod. They are too close together to provide a broad enough base for support.



The little 3mm brown tape tubes are still present. There are three pairs on this object. The ends are still like probes or pneumatic drills for breaking up concrete. They have tubes connected to them and are three headed. They are recoiling and bouncing back with the force of their efforts into almost impenetrable materials.

I've been trying really hard throughout all of this writing to be as neutral as I can in terms of how I refer to the objects. I've been trying not to anthropomorphise them in my descriptions and talk about their bodies for example but still often end up using legs or appendages to describe certain extensions. It's hard to be dispassionate but still be creative in my descriptions and let thoughts and ideas take me to different places. I can feel the effects of scientific analysis seeping in which is useful as long as it can merge with more lateral ways of thinking that allow discussion that is more open, less sensible and lets funny little thoughts in.

Tuesday 31 January

OBJECT 46

As I come closer to the end of this writing process, I am becoming more concerned about the content and publishing it. Making it public exposes an internalized thought process which was not supposed to be concerned about its reader – although the intention always was that it would be read (even if only by me).

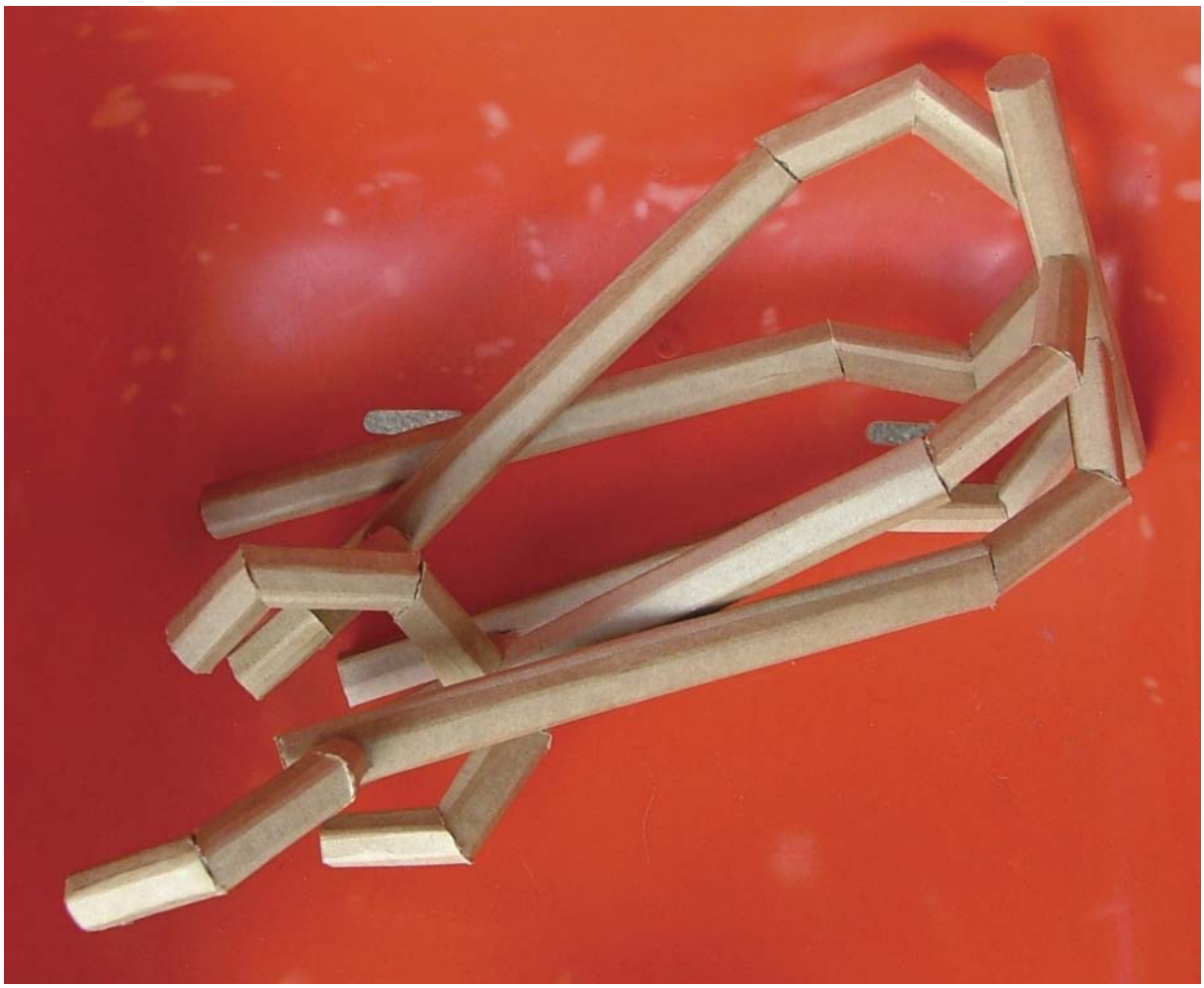
And again I find myself at a point of rupture, where suddenly certain characteristics are exaggerated and pushed to create new and different forms and structures. The 'Y' shape that allowed the last object to bifurcate has been replicated – there are now two of them end to end. There are four segmented sections extending from these. Each has one long tube of about 16 cm. Near the ends of these long tubes is another branching point with a tri-segmented structure like a little hook. It reaches out probing the space around these ends and providing stability. It is a tetrapod – a four legged being. The earliest tetrapods are descended from the lobe finned fishes that evolved into the air breathing amphibians that walked onto land.

I've written before about the murky, primordial swamps of the project and I'm getting excited as I know that I'm getting close to an important point in its evolution. Back in the very beginning of the project, in the test series, I was interested in legs but I soon wanted to make objects that were more abstract, less representational and more themselves. Despite this, I've constantly compared them to various living and non-living things. Now they have seemingly developed 'legs' independently of my intentions.

Tuesday 31 January

OBJECT 47

The 'Y' form has somehow been selected out during the construction process and in this object, the central form is a single tube from which 5 segmented parts extend. My thinking process is more efficient than my hands so by the time I've caught up by making the object I'm on to something else. It is impossible to document this without getting into my mind's eye or wherever it is the images form. Although they're not images, I can see them. Describing them using language is different– so much is lost in translation.



Near the ends of four of these extensions are the tri-segmented structures. The tubes look slightly smaller than the main tubes. One of the long tubes doesn't have one. All these long tubes are quite close together and don't provide a stable enough base to enable the object to be placed 'upright'. When I hold it upright, the tri-segmented structures look like probes testing substances in front of the structure. Upright it has a corporeal sensibility although it is acephalic(headless). Even without a cephalic like structure, it still appears to be facing and heading in a particular direction. It also appears to have a reverse end. Having a head, or at least the potential for one, provides a reference point that is useful for describing orientations.

Tuesday 7 February

OBJECT 48

This object is very similar in construction to the last. It now has six extensions or appendages joined to a central tube. Only four of these appendages are long enough to touch the ground and this contact is spread wide enough to allow the object to stand upright. (In human evolution, getting upright and becoming bipedal really enhanced brain development especially the cerebral cortex which is responsible for thinking and consciousness.) This object is still a tetrapod but it has additional extensions like arms as well. It actually appears bent over or hunched, held down by the weight and activity of its arms and legs.

This object also has a series of the tri-segmented hook shaped extensions and some of these have another hook and even another one attached to the previous hook. They look more like pincers or robotic arms for picking things up. They extend out from the main part of the object to protect it from coming into contain with external objects. It does look like

something out of a sci-fi movie something that would lumber along destroying things in its wake, terrifying everyone. Oskar thinks it is a thirteen legged 'lightning spider" – he included the tri-segmented extensions in the leg count.

Wednesday 8 February

OBJECT 49

Oskar is very keen to help with the descriptions again and quickly came up with an interesting description of the penultimate object (in this series at least). He described it as a 'city statue building'. He said, "It is a model of a building that you can walk inside. It is in the city. It is also a lookout building." It doesn't make much sense but I like it.

This object is less figurative than the last few. It no longer has the central form and it is this centrality that references the corporeal. It is more dispersed and without emphasis on any particular part. There is a nodal point where four parts meet and then another point where one tube joins to another but they just seem to be connected rather than actively branching off each other. The smaller tri-segmented hooks are still present. The larger structure appears to mimic their shape and has a similar visual value. I can count five appendages but they are not really like legs or feet. The object seems to have multiple orientations all of which seem as plausible as the others. This adds to its interest and broadens the possibilities for interpretation.

Oskar's references to the architectural are not surprising as this object speaks more of being built than objects that directly reference the biological. Ideas of scale are always present (especially in reference to giant spiders) but are more relevant in reference to built objects. This object could be really big. Perhaps parts of it could have a membrane or skin stretched over it to create enclosures. It would make a fabulous structure for a railway station – the trains could go under and through the form.

Tuesday 21 February

OBJECT 50

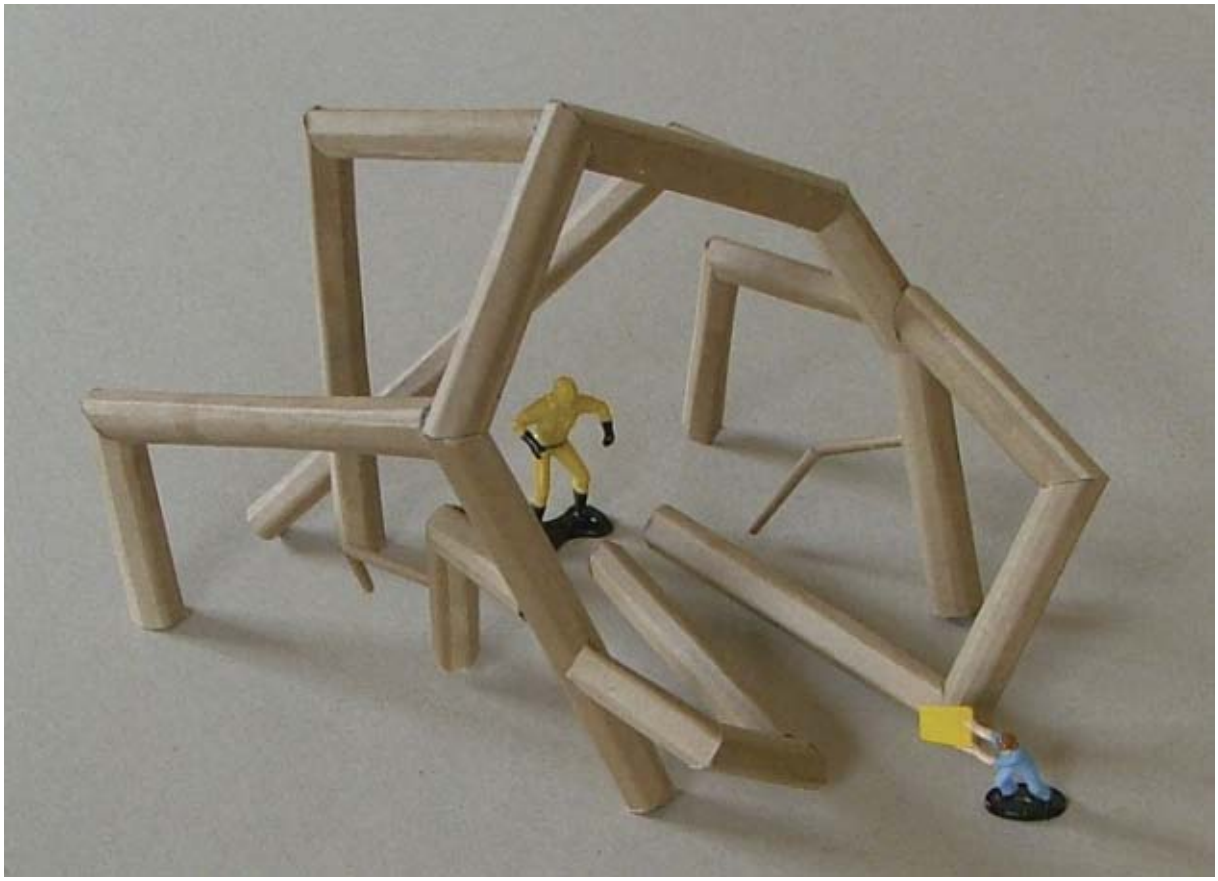
I feel quite reluctant to call this the ultimate object in the series. It really is no different from any other object – it just happens to be at a particular stage in my numbering system. It will still be used as a prompt for the next object in the new series regardless of when that new series begins or what form it takes. I suspect it will be in a new material but the specifics are out of the scope of the current project.

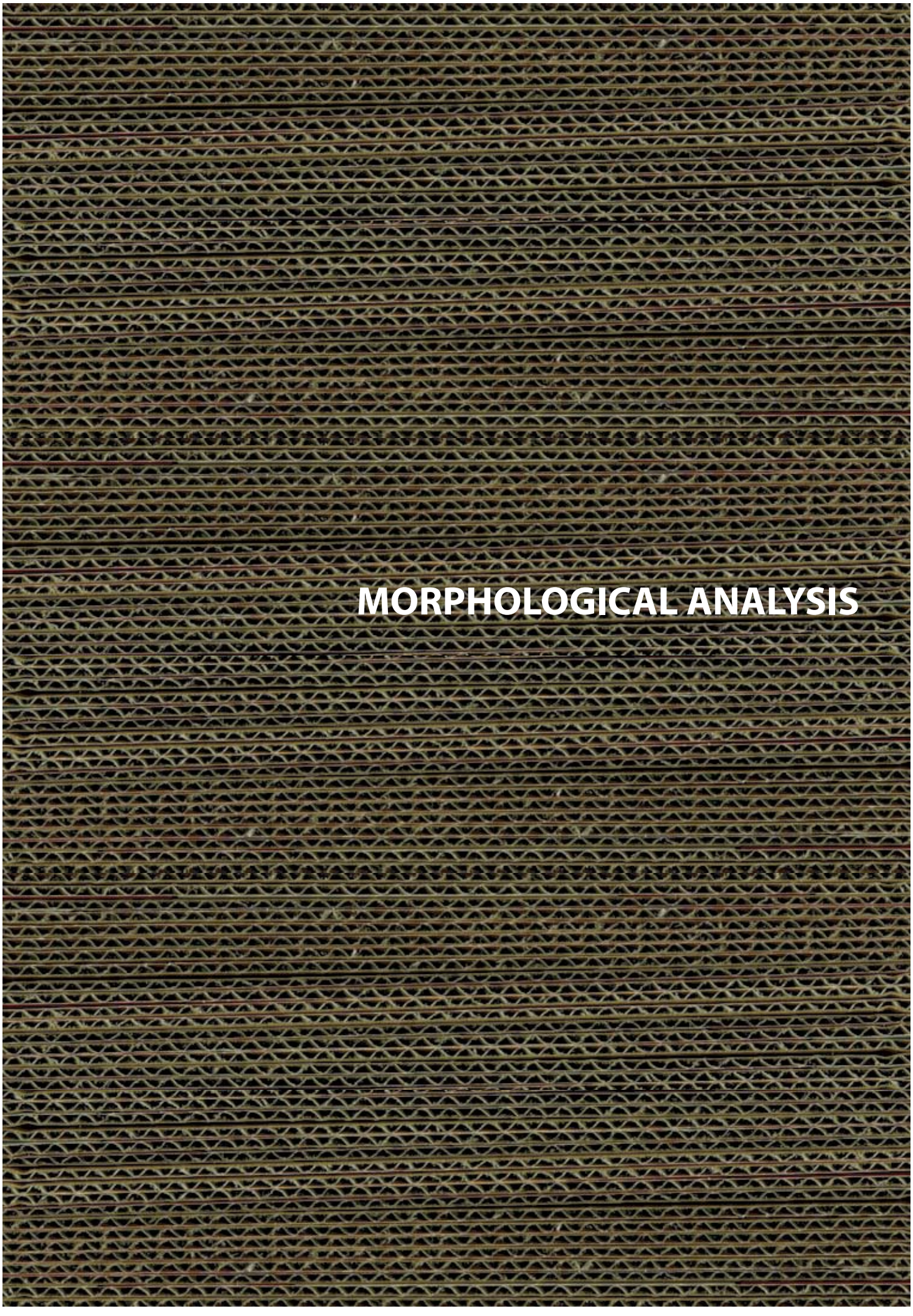
While I've been writing I've been dreading the end because I've felt the need to say something profound. I realize now that it isn't necessary. It is enough that the project has reached this nice neat point of a half century. It doesn't really matter what the object looks like or represents or whether it is interesting or not. It simply needs to exist…

This object is again very similar to the last. The tubes are longer and there are fewer segments than some of the more recent objects. It's now obvious that the multi-segmented structure is receding. The tri-segmented extensions have gone too. Similar structures are still present but only have two tubular pieces. They also appear to be part of the main structure rather than a secondary extension.

This structure is again quite amorphous with no real orienting features or central structures. It seems to have some architectural features and a definite arch is apparent in one position. Oskar described it as a hut without walls with a slide that acts as an entrance point. He is so sure of his interpretation and so keen to contribute. I can't work out what it is but I do like the way that many of the ends of the tubes seemingly bend towards the same directions like they are craning to hear something.

Most of the objects in the series have fitted in large zip lock bags from the supermarket and while I have not purposely constrained them, they have all more or less fitted in the bags. The last few objects either only just fit in very tightly or like this one don't fit in at all. It has outgrown the project and created a natural ending point. It's not really an end, more like a middle point – a point for offshoots, sequels and second thoughts…





MORPHOLOGICAL ANALYSIS

Morphology refers to the form and structure of an object without regard to its function. In this project, a form for data collection for morphological analysis was developed and completed for all 50 objects. An expanded version of this form was utilised for the first five objects and includes extra information and scientific drawings.

This section includes the following:

MORPHOLOGICAL ANALYSIS

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-000	Form No. 0000	**0000**

1.0	Date	Today's date	Insert key image here
1.1	Completion date	Date object completed	
1.2	Completion day	Day of the week	
1.3	Days since last object completed	No. of days since previous object completed	
1.4	Weight (g)	Weigh on scales	
1.5	Length (mm)	At longest point	
1.6	Width (mm)	At widest point	
1.7	Height (mm)	At highest point	

2.0	**Basic Morphology**	Linear ☐ Branched ☐ Spiral ☐ Curved ☐ *
2.1	Planarity	Simple ☐ Complex ☐*
2.2	Segmentation	Present ☐ Absent ☐*
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☐*
2.4	No. of discrete/connecting parts	Total number of individual parts including tubules, granulate nodules, setae, striations but not lamella.
2.5	No. of connections	Number of points where 2 or more parts connect
2.6	No. of self supporting orientations	Number of positions that object can rest in
2.7	No. of points of surface contact per orientation	Number of parts of the object in contact with the ground

3.0	**Tubular parts (tubules)**	Primary*	Secondary*	Tertiary*	Quaternary*
3.1	No. of tubules				
3.2	Length of tubules (mm)				
3.3	Diameter of tubules (mm)				

4.0	**Surface Characteristics**	Smooth ☐ Granulated ☐ Striated ☐*

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☐*
5.1	Total no. of granulate nodules	Count granulate nodules
5.2	No. of granulate nodules embedded with setea	Count number of granulate nodules with setae embedded

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-000	Form No. 0000	**0000**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☐*
6.1	Orientation of striations	Horizontal ☐ Vertical ☐*
6.2	Total no. of striations	Count approximate number of striations

7.0	**Epidermal layer lamella**	Present ☐ Absent ☐
7.1	Total no. of lamella pieces	Count number of lamella (do not include tape on long sides of tubules)
7.2	Basic description of lamella	Describe location and features

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☐*
8.1	Total no. of setae	Count number of setae
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length = if not standard

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	Count number of discs
9.2	No. of inter-segmental discs	Count number on external edges of structure
9.3	No. of intra-segmental discs	Count number within the structure

10.1	**Branching**	Present ☐ Absent ☐*			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☐*
11.2	Colour of internal cavities	Brown, pink and or white
11.3	No. of cavities visible	Count number of cavities

*See additional notes

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-000	Form No. 0000	**0000**

Additional notes

Basic Morphology

- Object can be described as one or a combination of the terms linear, branched, spiral or curved
- Objects must in part at least reflect the description.
- All or part of the object must be substantially straight to be described as LINEAR
- BRANCHED objects divide and separate
- SPIRAL objects form a continuous series of loops
- CURVED objects bend smoothly

Planarity

- Objects with COMPLEX planarity can be rotated on several axes and can be oriented on multiple planes
- Objects with SIMPLE planarity generally have a single plane

Segmentation

- if present, objects are divided into smaller, repeating and often regular parts.

Symmetry

- the right and left sides of BILATERALLY symmetrical objects are mirror images
- the parts of RADIAL symmetrical objects radiate around a central point
- the front and back sides of AXIALLY symmetrical objects are mirror images

Primary, Secondary, Tertiary and Quaternary

- primary is the largest, quaternary the smallest
- this measurement is based on the diameter of the tubule

Surface Characteristics

- GRANULATED objects are covered in small clear nodules
- STRIATED objects are covered in long clear stripes, their orientations are determined using the orientation of the object in the key image
- SMOOTH objects have an even surface without attachments

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-000	Form No. 0000	**0000**

Lamella

- paper thin layer on surfaces of objects

Setae

- bristle like structures extending from the surface or ends of objects
- often found embedded in granulate nodules
- standard length is 1cm but are found in different lengths

Segmental discs

- discs that are usually inter or intra segmental (on the edges of or between segments)

Presentation

- CONTINUOUS if the object is covered
- TERMINAL if they are present on the ends of parts of the object
- BASAL if they are present close to the central largest part (if present)

Branching

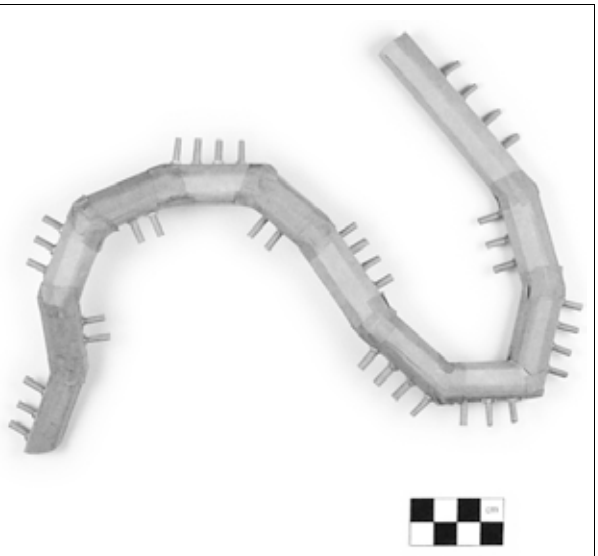
- occurs when a new part bifurcates or splits off
- these birfurcations can be enumerated and the angle /s at which they extend from the original part can be measured
- position of branches refers to orientation

Internal cavities

- generally visible at the end of tubules although can be covered with lamellae

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No.: 2-001	Form No.: 0001	**0001**

Date	23 March 2007
Completion date	28 April 2005
Completion day	Friday
Days since last object completed (DLOC)	-
Weight (g)	24
Length (mm)	245
Width (mm)	190
Height (mm)	59



Basic Morphology	Linear ☑ Branched ☐ Spiral ☐ Curved ☑
Planarity	Single ☐ Multiple ☑
Segmentation	Present ☑ Absent ☐
Symmetry	Bilateral ☐ Radial ☐ Asymmetrical ☑

No. of discrete/connecting parts	88					
No. of connections	87					
No. of self supporting orientations	2					
No. of points of surface contact per orientation	2	1				
Further details of orientations	1. Contact points at each end, not stable 2. Single contact point along 3/4 length of object, 3 segments then lift at approx 20 degrees					

Tubular parts (tubules)	Primary	Secondary	Tertiary	Quaternary
No. of tubules	12	38 (setae)		
Length of tubules (mm)	40 - 82	10		
Diameter of tubules (mm)	12 - 21	2.5		

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2 - 001	Form No. 0001	**0002**

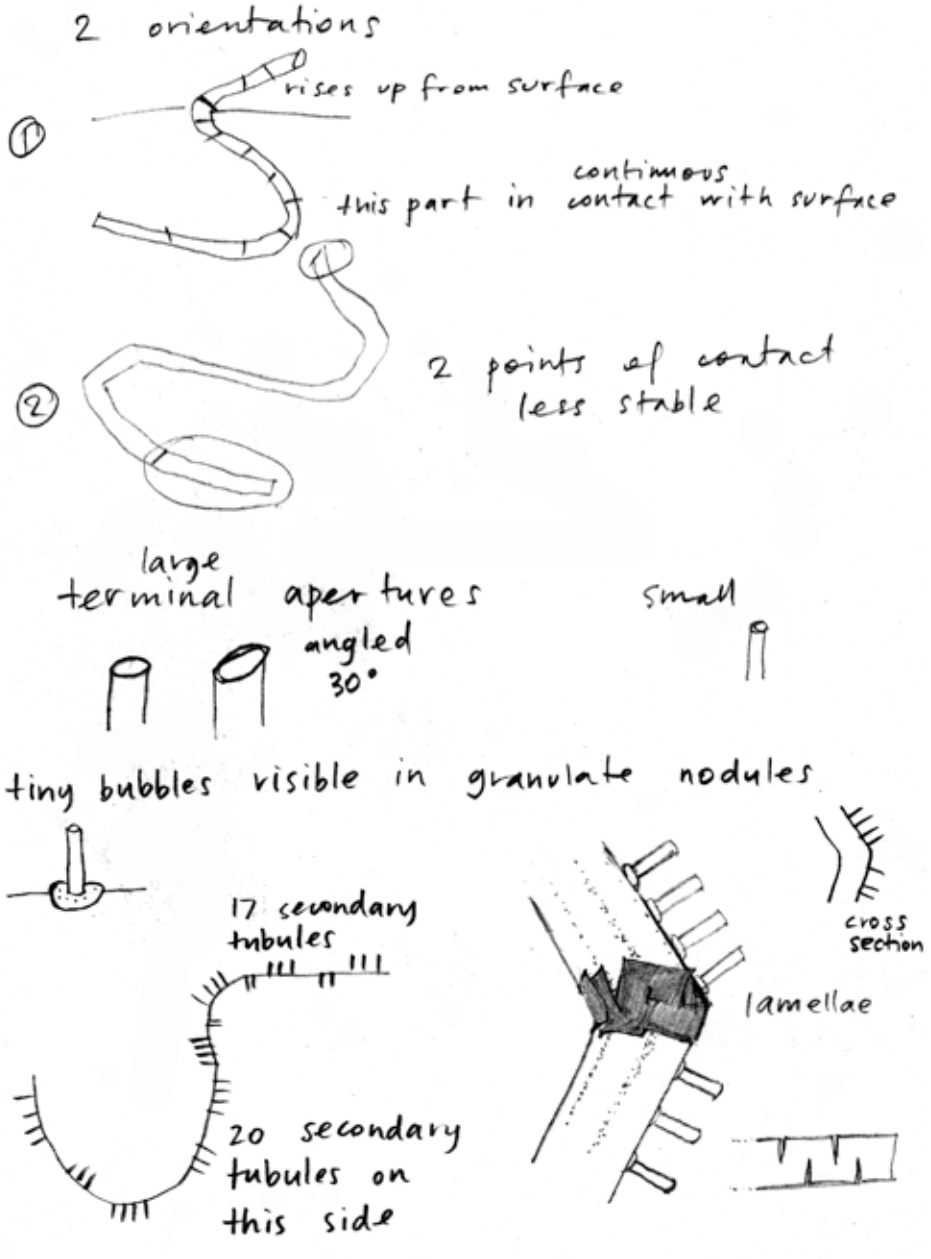
Surface Characteristics	Smooth ☑ Granulated ☑ Striated ☐
Position/s of granulate nodules	Continuous ☐ Terminal ☐ Basal ☑
Total no. of granulate nodules	38
Description of granulate nodules on individual structures/parts of structures	Located at the base of secondary tubules in groups of 2, 3, 4 Ie. 3 groups of 2 nodules, 4 groups of 3 and 5 groups of4
Orientation of striations	Horizontal ☐ Vertical ☐
Position/s of striations	Continuous ☐ Terminal ☐ Basal ☐
Total no. of striations	-
Epidermal layer lamella	Present ☑ Absent ☐
Total no. of lamella pieces	11
Description of lamella	11 pieces joining segments

Branching	Present ☐ Absent ☑			
Branches	Primary	Secondary	Tertiary	Quaternary
No. of bifurcations				
Angle of branches				
Length of branches (mm)				
Diameter of branches (mm)				
Position of branches				

Internal cavities	Visible ☑ Not Visible ☐
Colour of internal cavities	brown
No. of terminal apertures	2
No. of proximal apertures	-

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-001	Form No. 0001	**0003**

Additional notes



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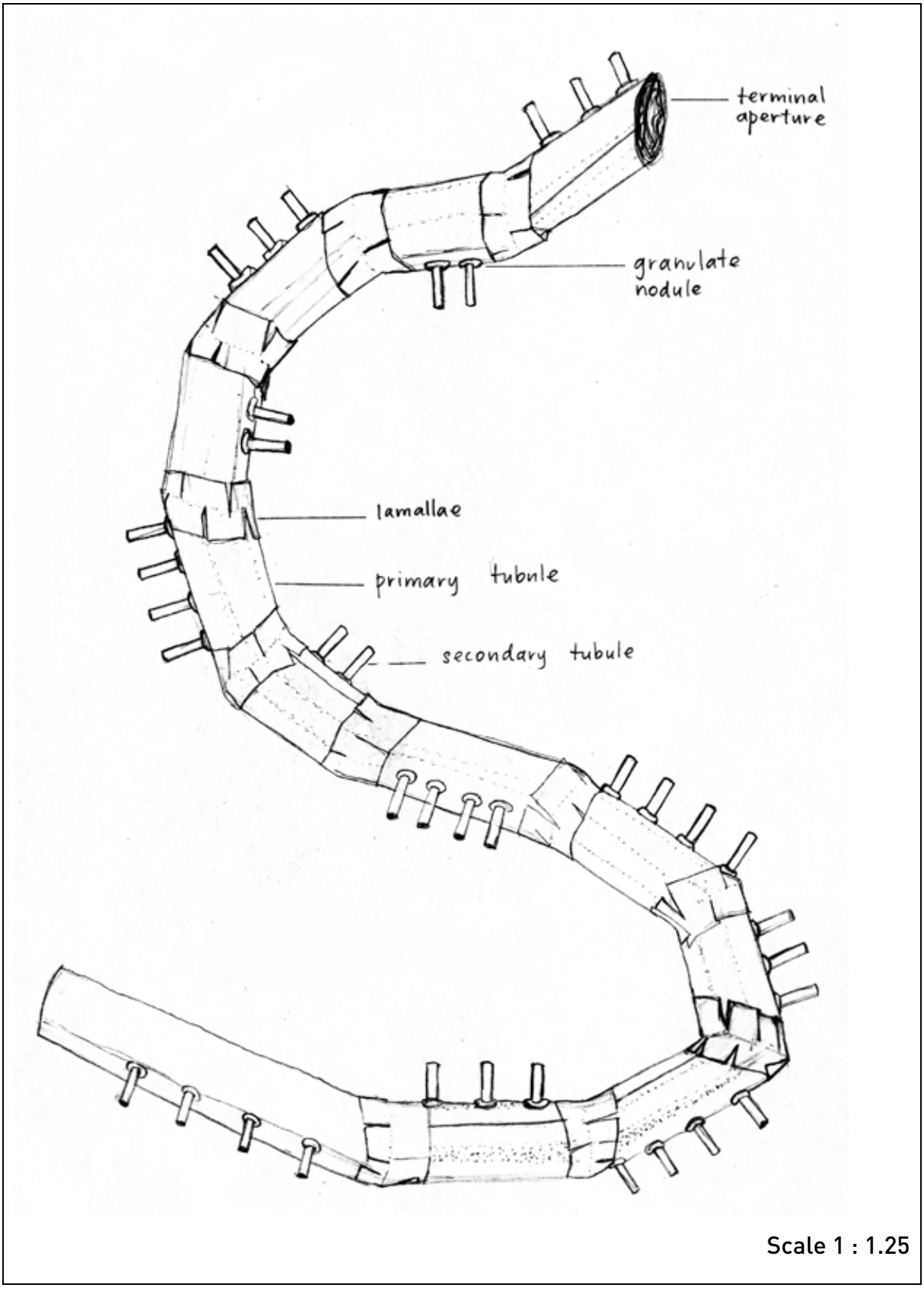
Object No. 2 - 001	Form No. 0001	**0004**



Scale 1 : 1.25

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-002	Form No. 0002	**0005**

Date	25 March 2007
Completion date	3 May 2005
Completion day	Tuesday
Days since last object completed (DLOC)	4
Weight (g)	10
Length (mm)	108
Width (mm)	42
Height (mm)	42

Basic Morphology	Linear ☑ Branched ☐ Spiral ☐ Curved ☐
Planarity	Single ☑ Multiple ☐
Segmentation	Present ☐ Absent ☑
Symmetry	Bilateral ☑ Radial ☑ Asymmetrical ☐

No. of discrete/connecting parts	165					
No. of connections	164					
No. of self supporting orientations	11					
No. of points of surface contact per orientation	1	1	4	4	11	7
	5	19	14	3	5	
Further details of orientations	Object rolls over resting on 9 rows of tubules. Surface contacts made by individual secondary tubules. Also stands on either end of primary tubule.					

Tubular parts (tubules)	Primary	Secondary	Tertiary	Quaternary
No. of tubules	1	82 (setae)		
Length of tubules (mm)	108	10		
Diameter of tubules (mm)	20	2.5 – 3.1		

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-002	Form No. 0002	**0006**

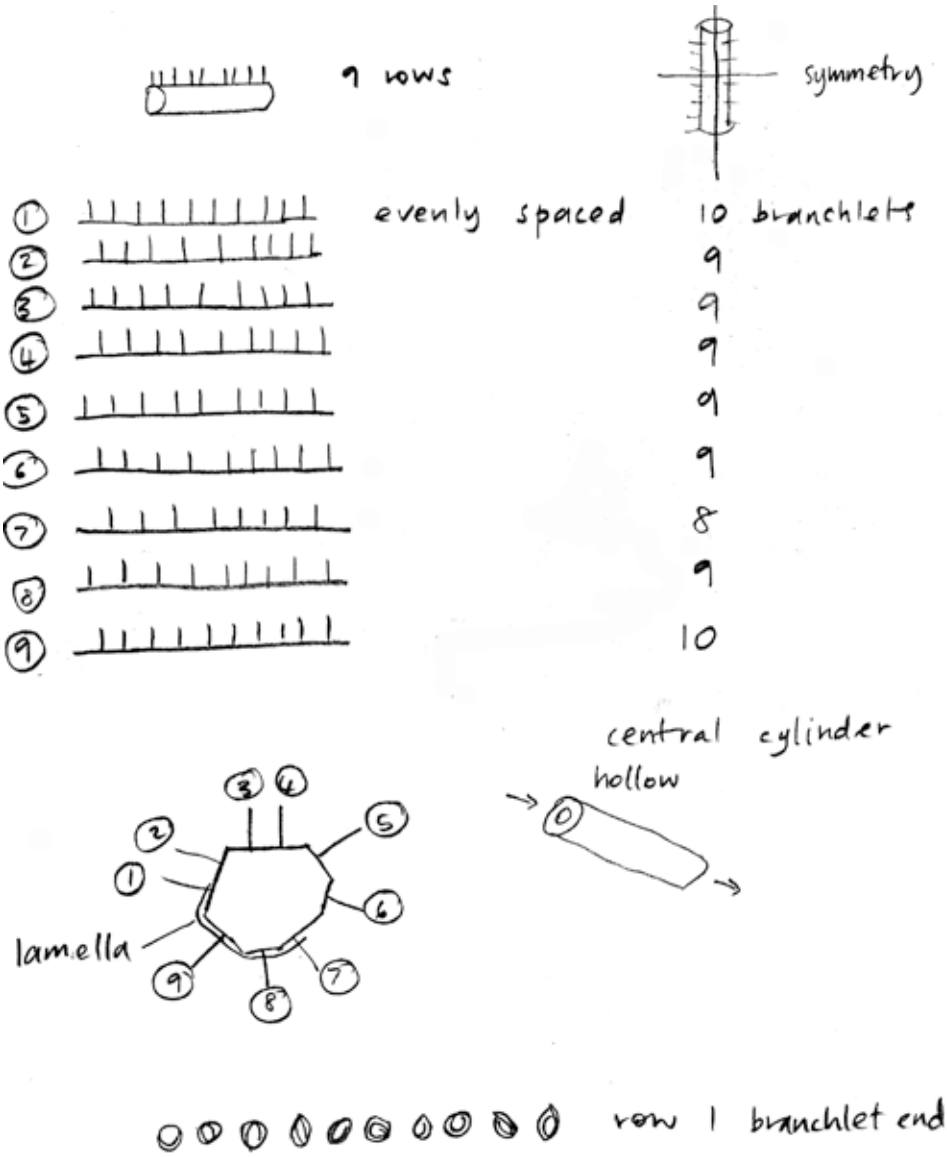
Surface Characteristics	Smooth ☑ Granulated ☑ Striated ☐
Position/s of granulate nodules	Continuous ☑ Terminal ☐ Basal ☑
Total no. of granulate nodules	82
Description of granulate nodules on individual structures/parts of structures	Located at the base of secondary tubules. Ends of these tubules are embedded in the granulate nodules.
Orientation of striations	Horizontal ☐ Vertical ☐
Position/s of striations	Continuous ☐ Terminal ☐ Basal ☐
Total no. of striations	-
Epidermal layer lamella	Present ☐ Absent ☑
Total no. of lamella pieces	-
Description of lamella	Running along length of primary tubule.

Branching	Present ☐ Absent ☑			
Branches	Primary	Secondary	Tertiary	Quaternary
No. of bifurcations				
Angle of branches (degree)				
Length of branches (mm)				
Diameter of branches (mm)				
Position of branches				

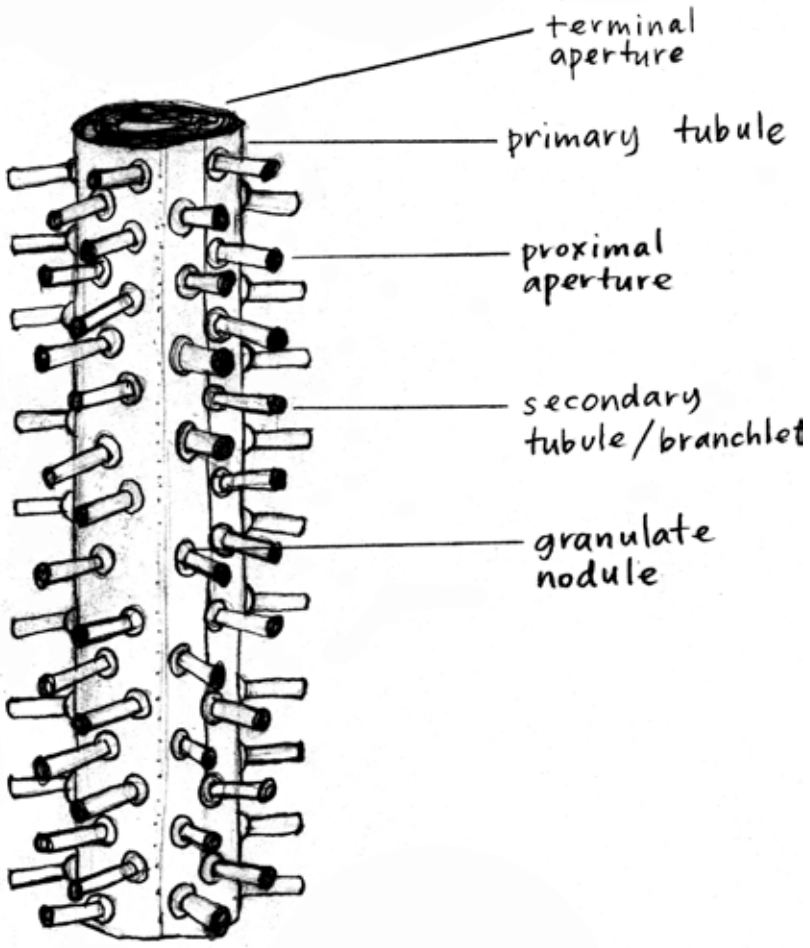
Internal cavities	Visible ☑ Not Visible ☐
Colour of internal cavities	brown
No. of terminal apertures	2
No. of proximal apertures	-

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-002	Form No. 0002	**0007**

Additional notes



Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-002	Form No. 0002	**0008**



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Missing Links Data Collection	MORPHOLOGICAL ANALYSIS
Object No. 2-003	Form No. 0003

0009

Date	27 March 2007
Completion date	6 May 2005
Completion day	Friday
Days since last object completed (DLOC)	3
Weight (g)	10
Length (mm)	159
Width (mm)	120
Height (mm)	34

Basic Morphology	Linear ☐ Branched ☑ Spiral ☐ Curved ☐
Planarity	Single ☑ Multiple ☐
Segmentation	Present ☑ Absent ☐
Symmetry	Bilateral ☐ Radial ☐ Asymmetrical ☑

No. of discrete/connecting parts	75					
No. of connections	74					
No. of self supporting orientations	3					
No. of points of surface contact per orientation	3	5	5			
Further details of orientations	1. Most stable orientation. 2. Pivots on secondary tubules 3. As above					

Tubular parts (tubules)	Primary	Secondary	Tertiary	Quaternary
No. of tubules	1	2	36 (setae)	
Length of tubules (mm)	157	52/54	10	
Diameter of tubules (mm)	13 – 21	9-12/13	2.5	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-0003	Form No. 003	**0010**

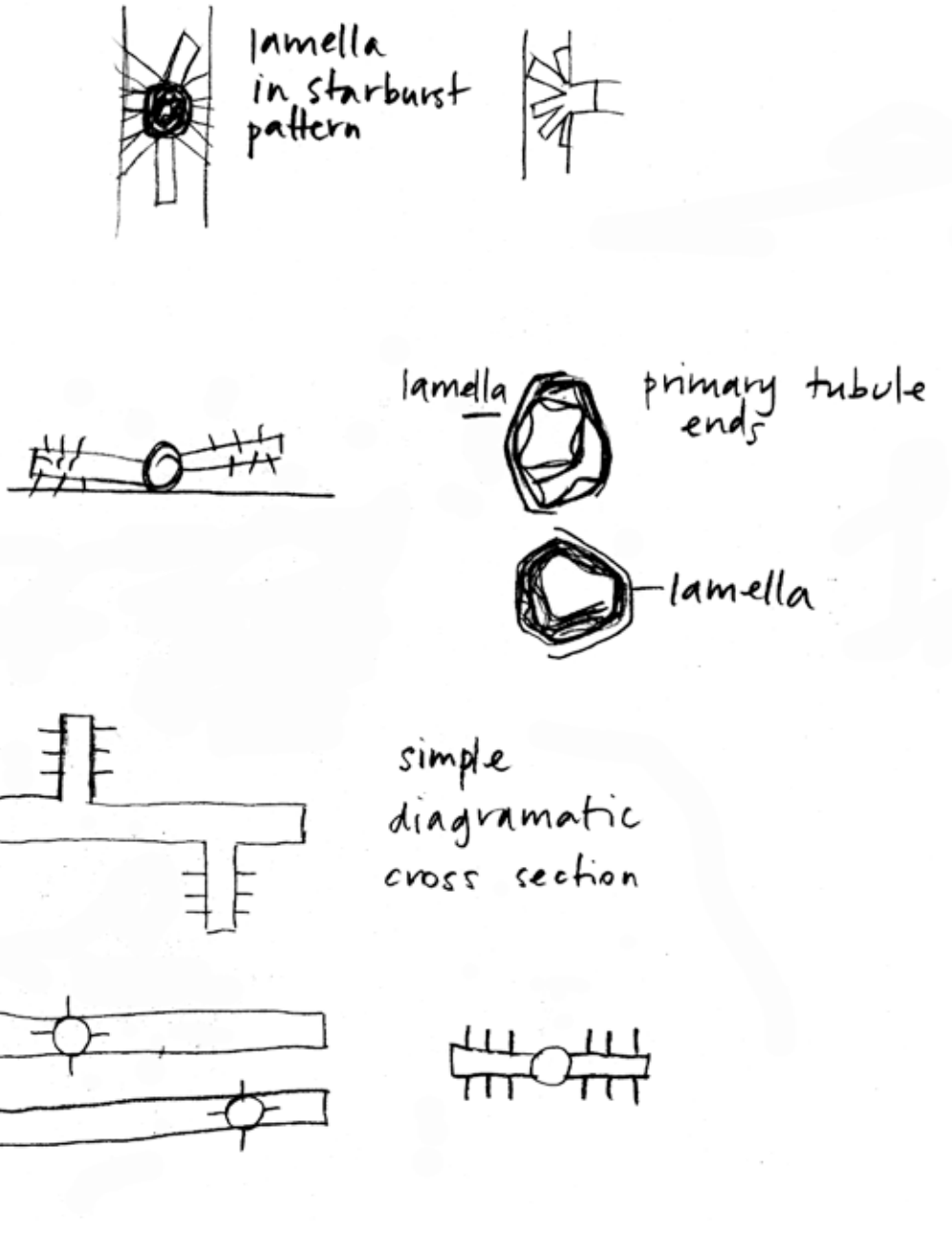
Surface Characteristics	Smooth ☑ Granulated ☑ Striated ☐
Position/s of granulate nodules	Continuous ☐ Terminal ☐ Basal ☑
Total no. of granulate nodules	36
Description of granulate nodules on individual structures/parts of structures	Radial and terminal on secondary tubules in rows of 3.
Orientation of striations	Horizontal ☐ Vertical ☐
Position/s of striations	Continuous ☐ Terminal ☐ Basal ☐
Total no. of striations	-
Epidermal layer lamella	Present ☑ Absent ☐
Total no. of lamella pieces	4
Description of lamella	Along length of primary and secondary tubules and flanged along joins.

Branching	Present ☑ Absent ☐			
Branches	Primary	Secondary	Tertiary	Quaternary
No. of bifurcations	2	36		
Angle of branches(degrees)	90	90		
Length of branches (mm)	52/54	10		
Diameter of branches (mm)	9-12/13	2.5		
Position of branches	Radial and terminal			

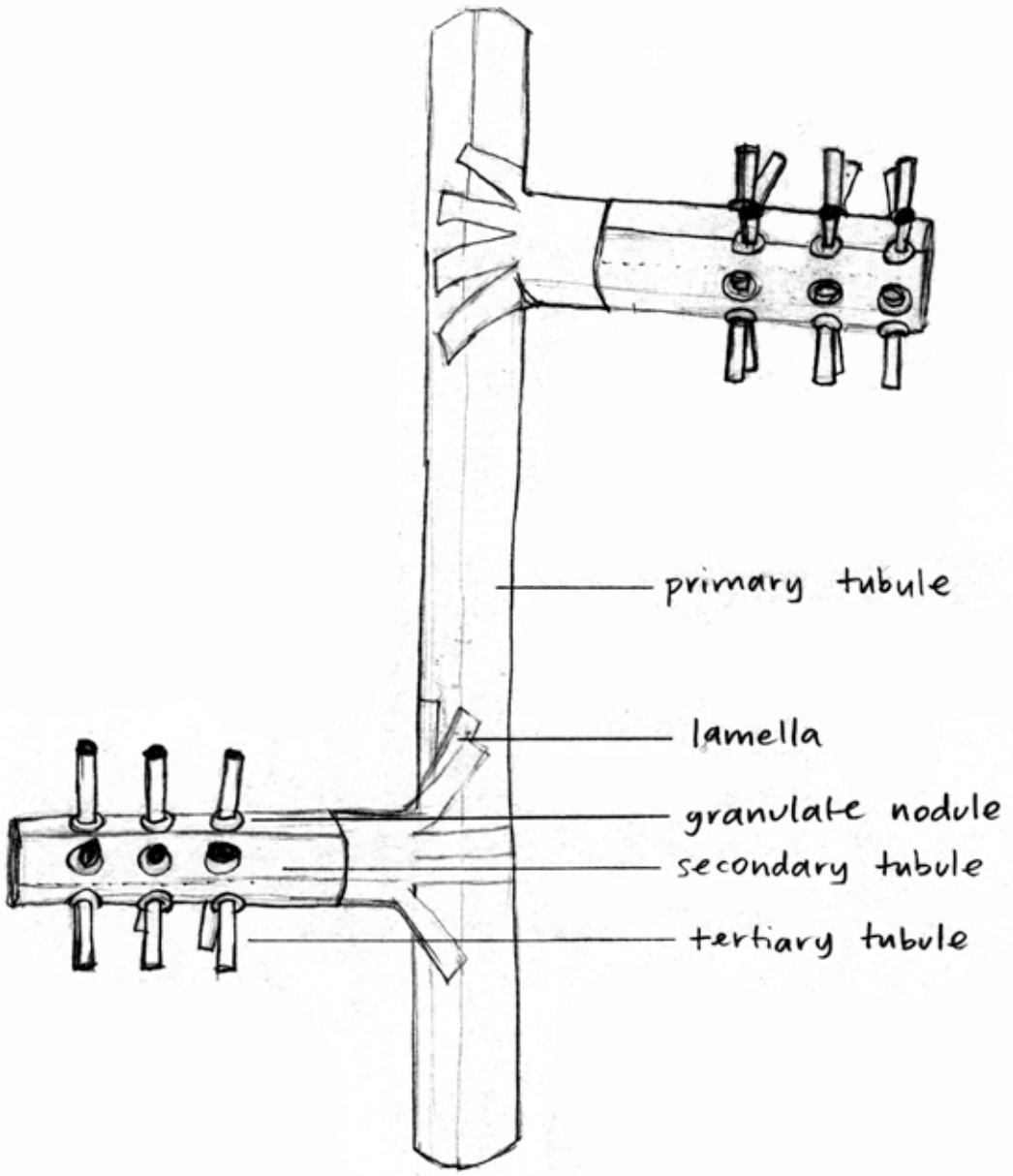
Internal cavities	Visible ☑ Not Visible ☐
Colour of internal cavities	brown
No. of terminal apertures	4
No. of proximal apertures	-

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-003	Form No. 0003	**0011**

Additional notes



Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-003	Form No. 0003	**0012**



1 : 1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-004	Form No. 0004	**0013**

Date	27 March 2007
Completion date	9 May 2005
Completion day	Monday
Days since last object completed (DLOC)	3
Weight (g)	20
Length (mm)	262
Width (mm)	110
Height (mm)	259

Basic Morphology	Linear ☑ Branched ☑ Spiral ☐ Curved ☐
Planarity	Single ☑ Multiple ☐
Segmentation	Present ☐ Absent ☑
Symmetry	Bilateral ☐ Radial ☐ Asymmetrical ☑

No. of discrete/connecting parts	121					
No. of connections	120					
No. of self supporting orientations	3					
No. of points of surface contact per orientation	2	3	3			
Further details of orientations	1. lying on side A 2. lying on side B 3. standing on ends					

Tubular parts (tubules)	Primary	Secondary	Tertiary	Quaternary
No. of tubules	4	3		
Length of tubules (mm)	154 163 165 149	60 50 61		
Diameter of tubules (mm)	11	9		

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-004	Form No. 0004	**0014**

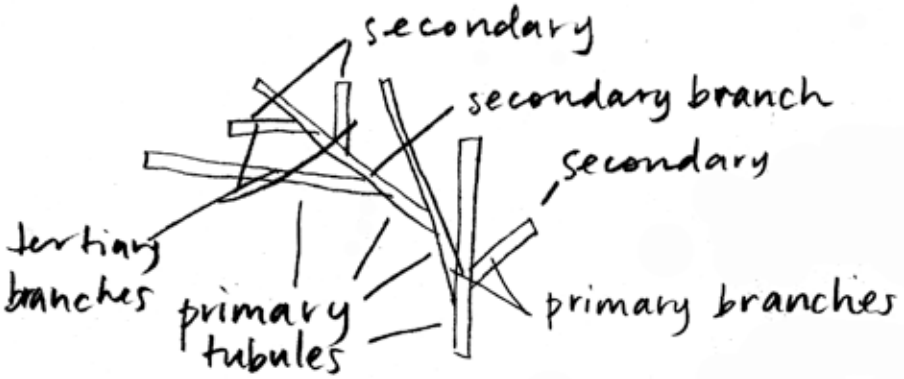
Surface Characteristics	Smooth ☑ Granulated ☑ Striated ☐
Position/s of granulate nodules	Continuous ☐ Terminal ☑ Basal ☐
Total no. of granulate nodules	114
Description of granulate nodules on individual structures/parts of structures	Positioned on ends of tubules in rows - 2 x 5, 3 x 6, 4 x 6, 2 x 5, 3 x 6, 2 x 5, 4 x 6
Orientation of striations	Horizontal ☐ Vertical ☐
Position/s of striations	Continuous ☐ Terminal ☐ Basal ☐
Total no. of striations	-
Epidermal layer lamella	Present ☑ Absent ☐
Total no. of lamella pieces	2
Description of lamella	Running along tubules, covering 1 join

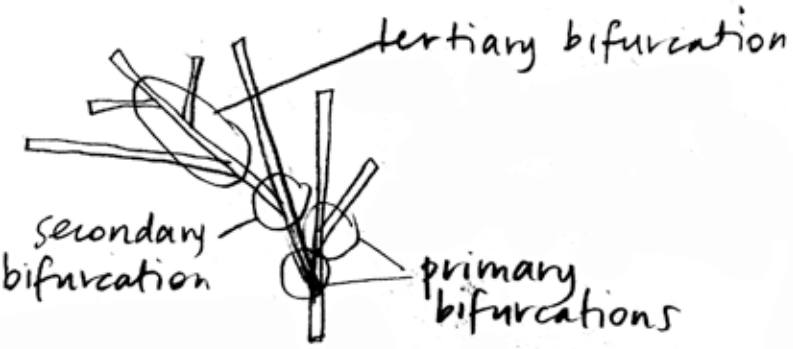
Branching	Present ☑ Absent ☐			
Branches	Primary	Secondary	Tertiary	Quaternary
No. of bifurcations	2	1	3	
Angle of branches (degrees)	60 70	65	70 60 60	
Length of branches (mm)	61 167	164	148 60 50	
Diameter of branches (mm)	9 11	11	11 9 9	
Position of branches	See notes			

Internal cavities	Visible ☑ Not Visible ☐
Colour of internal cavities	Brown, blue
No. of terminal apertures	8 (continuous line of sight through one)
No. of proximal apertures	-

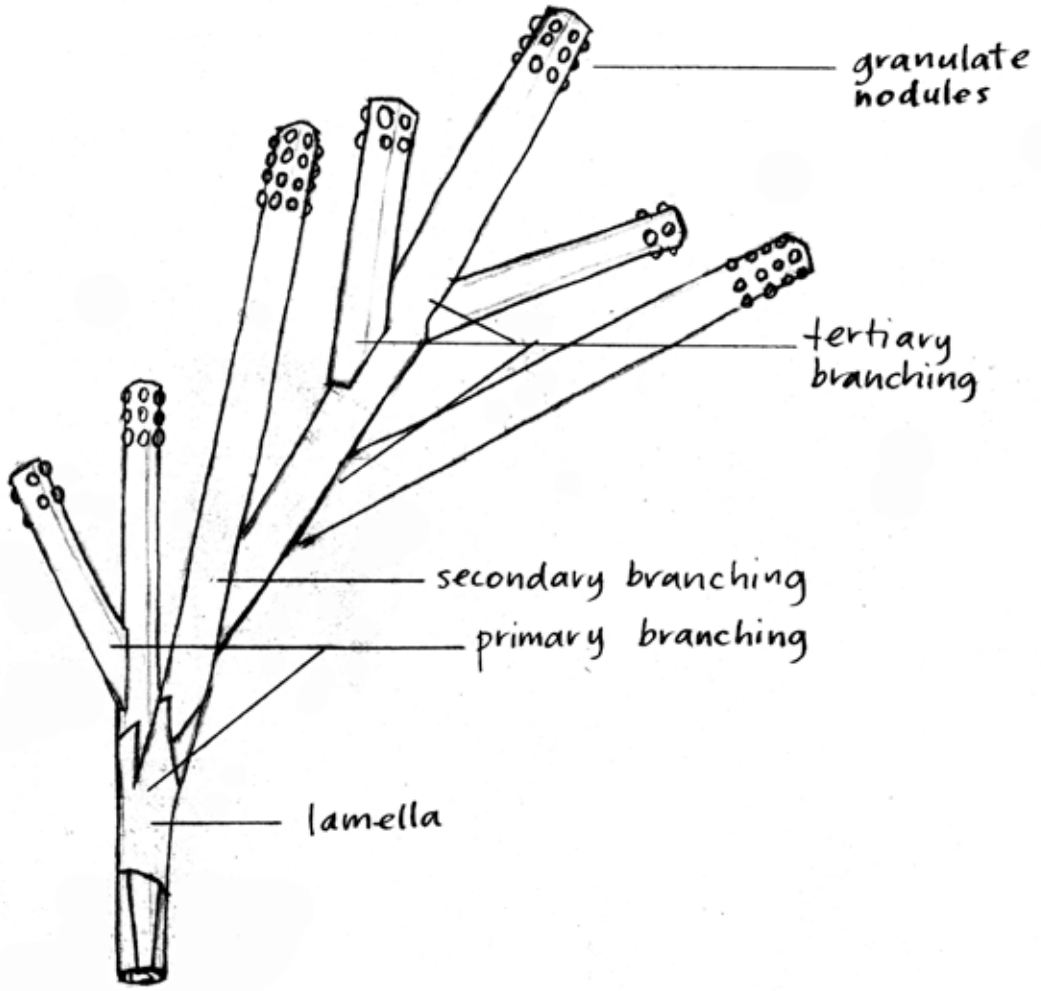
Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-004	Form No. 0004	**0015**

Additional notes





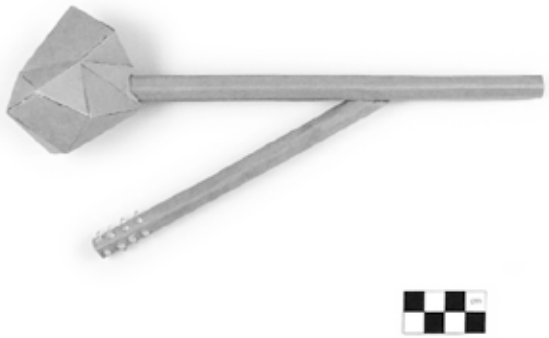
Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-004	Form No. 0004	**0016**



1 : 2

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-005	Form No. 0005	**0017**

Date	29 March 2007
Completion date	13 May 2005
Completion day	Friday
Days since last object completed (DLOC)	4
Weight (g)	15
Length (mm)	255
Width (mm)	116
Height (mm)	75



Basic Morphology	Linear ☑ Branched ☑ Spiral ☐ Curved ☐
Planarity	Single ☑ Multiple ☐
Segmentation	Present ☑ Absent ☐
Symmetry	Bilateral ☐ Radial ☐ Asymmetrical ☑

No. of discrete/connecting parts	45					
No. of connections	63					
No. of self supporting orientations	4					
No. of points of surface contact per orientation	3	3	2	3		
Further details of orientations	Object rotated clockwise from position pictured. Object does not stand up on either end.					

Tubular parts (tubules)	Primary	Secondary	Tertiary	Quaternary
No. of tubules	1	1		
Length of tubules (mm)	193	153		
Diameter of tubules (mm)	12	11		

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-005	Form No. 0005	**0018**

Surface Characteristics	Smooth ☑ Granulated ☑ Striated ☐
Position/s of granulate nodules	Continuous ☐ Terminal ☑ Basal ☐
Total no. of granulate nodules	20
Description of granulate nodules on individual structures/parts of structures	Occur in rows of 4 around the end of the secondary tubule.
Orientation of striations	Horizontal ☐ Vertical ☐
Position/s of striations	Continuous ☐ Terminal ☐ Basal ☐
Total no. of striations	-
Epidermal layer lamella	Present ☐ Absent ☑
Total no. of lamella pieces	-
Description of lamella	-

Branching	Present ☑ Absent ☐			
Branches	Primary	Secondary	Tertiary	Quaternary
No. of bifurcations	1			
Angle of branches (degrees)	65			
Length of branches (mm)	153			
Diameter of branches (mm)	11			
Position of branches				

Internal cavities	Visible ☑ Not Visible ☐
Colour of internal cavities	Brown, blue
No. of terminal apertures	2
No. of proximal apertures	-

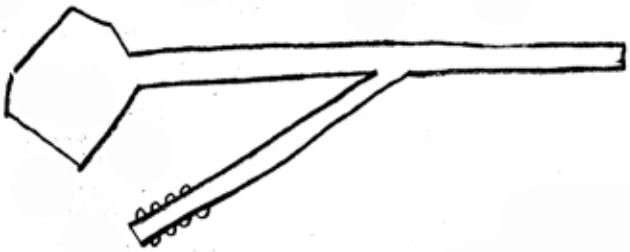
Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-005	Form No. 0005	**0019**

Additional notes

from above

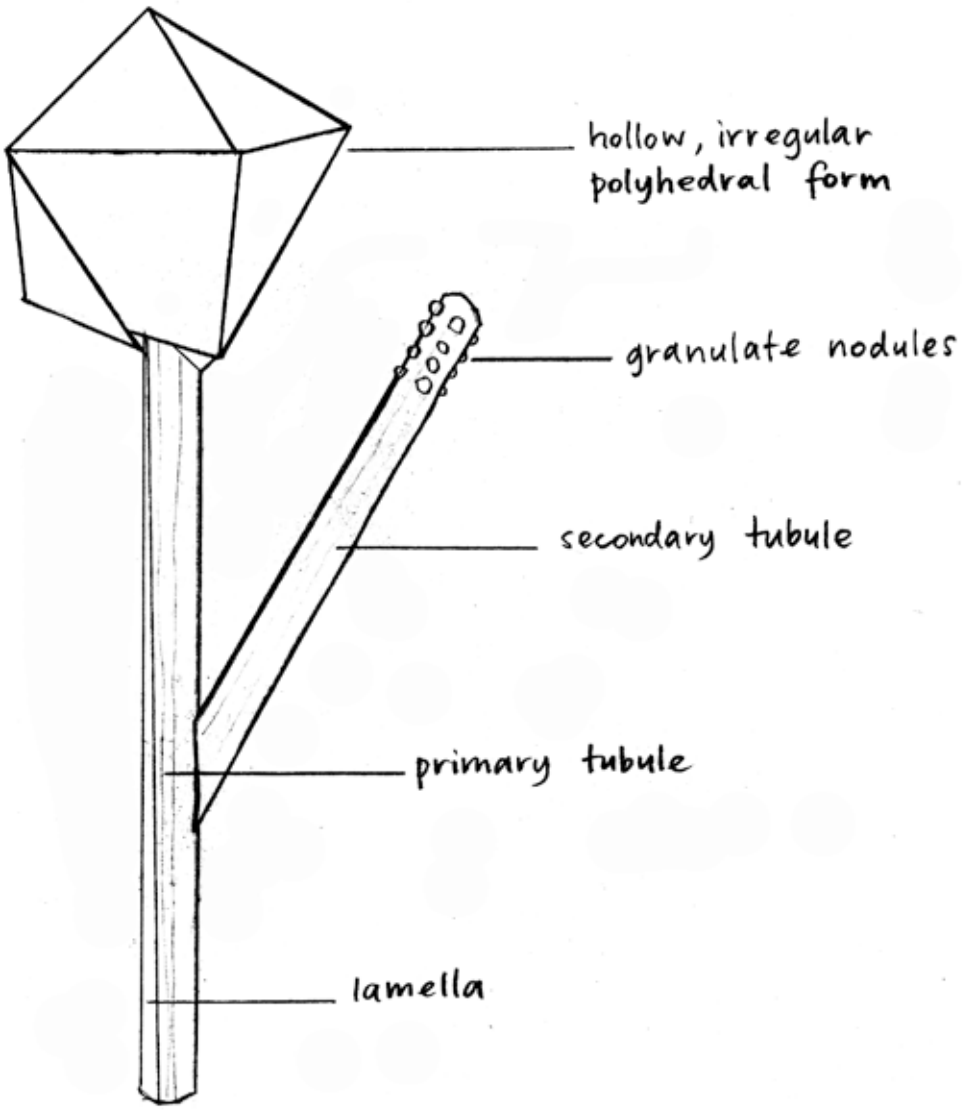
irregular polyhedron

external join between 2 tubules - no lamella in join



outline/ cross section

Missing Links Data Collection	MORPHOLOGICAL ANALYSIS	
Object No. 2-005	Form No. 0005	**0020**



1 : 2

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-006	Form No. 0006	**0021**

1.0	Date	29/3/07	
1.1	Completion date	13/05/07	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	13	
1.5	Length (mm)	304	
1.6	Width (mm)	40	
1.7	Height (mm)	60	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	52					
2.5	No. of connections	66					
2.6	No. of self supporting orientations	4					
2.7	No. of points of surface contact per orientation	3	4	3	2		

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1			
3.2	Length of tubules (mm)	300			
3.3	Diameter of tubules (mm)	15			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	16
5.2	No. of granulate nodules embedded with setea	16

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-006	Form No. 0006	**0022**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	16
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-007	Form No. 0007	**0023**

1.0	Date	29/03/07	
1.1	Completion date	17/05/05	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	4	
1.4	Weight (g)	22	
1.5	Length (mm)	310	
1.6	Width (mm)	63	
1.7	Height (mm)	55	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	101					
2.5	No. of connections	110					
2.6	No. of self supporting orientations	4					
2.7	No. of points of surface contact per orientation	2	4	3	3		

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1			
3.2	Length of tubules (mm)	299			
3.3	Diameter of tubules (mm)	11			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	44
5.2	No. of granulate nodules embedded with setea	44

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-007	Form No. 0007	**0024**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

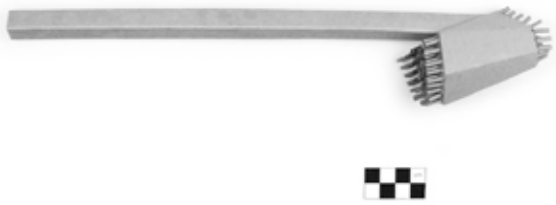
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	44
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-008	Form No. 0008	**0025**

1.0	Date	31/03/07	
1.1	Completion date	18/05/05	
1.2	Completion day	WEDNESDAY	
1.3	Days since last object completed	1	
1.4	Weight (g)	19	
1.5	Length (mm)	340	
1.6	Width (mm)	60	
1.7	Height (mm)	47	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	191					
2.5	No. of connections	200					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	2	2				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1			
3.2	Length of tubules (mm)	305			
3.3	Diameter of tubules (mm)	19			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	91
5.2	No. of granulate nodules embedded with setea	91

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-008	Form No. 0008	**0026**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	91
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-0009	Form No. 0009	**0027**

1.0	Date	31/03/07	
1.1	Completion date	20/05/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	1	
1.4	Weight (g)	15	
1.5	Length (mm)	244	
1.6	Width (mm)	45	
1.7	Height (mm)	46	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	38					
2.5	No. of connections	37					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	1	6				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1			
3.2	Length of tubules (mm)	228			
3.3	Diameter of tubules (mm)	20			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
5.1	Total no. of granulate nodules	35
5.2	No. of granulate nodules embedded with setea	35

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-009	Form No. 0009	**0028**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	4
7.2	Basic description of lamella	CIRCLES ON SEGMENTAL DISCS

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	35
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	2
9.2	No. of inter-segmental discs	1
9.3	No. of intra-segmental discs	1

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	WHITE
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-010	Form No. 0010	**0029**

1.0	Date	31/03/07	
1.1	Completion date	24/05/05	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	4	
1.4	Weight (g)	10	
1.5	Length (mm)	287	
1.6	Width (mm)	30	
1.7	Height (mm)	34	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	64					
2.5	No. of connections	63					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	2	2	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1			
3.2	Length of tubules (mm)	273			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
5.1	Total no. of granulate nodules	40
5.2	No. of granulate nodules embedded with setea	20

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-010	Form No. 0010	**0030**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	8
7.2	Basic description of lamella	CIRCLES ON SEGMENTAL DISCS

8.0	**Setae**	Continuous ☐ Terminal ☑Basal ☐ Absent ☐
8.1	Total no. of setae	20
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	4
9.2	No. of inter-segmental discs	2
9.3	No. of intra-segmental discs	2

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-011	Form No. 0011	**0031**

1.0	Date	26 //04/07	
1.1	Completion date	24/05/05	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	14	
1.5	Length (mm)	178	
1.6	Width (mm)	37	
1.7	Height (mm)	34	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☐ Absent ☑					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	108					
2.5	No. of connections	107					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	4	3	4			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	4			
3.2	Length of tubules (mm)	31/49/56/173			
3.3	Diameter of tubules (mm)	9			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	62
5.2	No. of granulate nodules embedded with setea	28

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-011	Form No. 0011	**0032**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	10
7.2	Basic description of lamella	CIRCLES ON SEGMENTAL DISCS

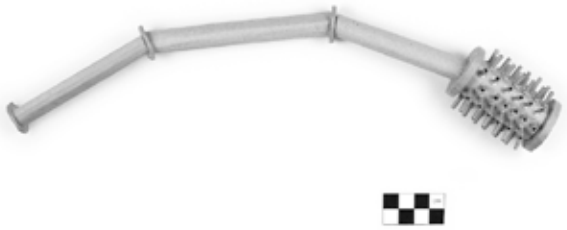
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	28
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	5
9.2	No. of inter-segmental discs	2
9.3	No. of intra-segmental discs	3

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-012	Form No. 0012	**0033**

1.0	Date	26/04/07	
1.1	Completion date	03/06/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	10	
1.4	Weight (g)	24	
1.5	Length (mm)	350	
1.6	Width (mm)	45	
1.7	Height (mm)	43	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☐ Axial ☐ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	82					
2.5	No. of connections	81					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	5	6				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	3		
3.2	Length of tubules (mm)	53	87/95/120		
3.3	Diameter of tubules (mm)	26	20		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	73
5.2	No. of granulate nodules embedded with setea	73

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-012	Form No. 0012	**0034**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	10
7.2	Basic description of lamella	CIRCLES ON SEGMENTAL DISCS

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	73
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	5
9.2	No. of inter-segmental discs	2
9.3	No. of intra-segmental discs	3

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-013	Form No. 0013	**0035**

1.0	Date	09/06/07	
1.1	Completion date	08/06/05	
1.2	Completion day	WEDNESDAY	
1.3	Days since last object completed	5	
1.4	Weight (g)	26	
1.5	Length (mm)	295	
1.6	Width (mm)	50	
1.7	Height (mm)	50	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	93					
2.5	No. of connections	92					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	4	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	4		
3.2	Length of tubules (mm)	53	70/73/75/120		
3.3	Diameter of tubules (mm)	27	15		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	41
5.2	No. of granulate nodules embedded with setea	41

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-013	Form No. 0013	**0036**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	-

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	-
7.2	Basic description of lamella	-

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	41
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	6
9.2	No. of inter-segmental discs	2 (34mm diameter)
9.3	No. of intra-segmental discs	4 (24mm diameter)

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-014	Form No. 0014	**0037**

1.0	Date	10/06/07	
1.1	Completion date	01/07/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	22	
1.4	Weight (g)	39	
1.5	Length (mm)	327	
1.6	Width (mm)	45	
1.7	Height (mm)	50	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	115					
2.5	No. of connections	114					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	5	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	2	3		
3.2	Length of tubules (mm)	55/60	100/110/120		
3.3	Diameter of tubules (mm)	25	17		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
5.1	Total no. of granulate nodules	52
5.2	No. of granulate nodules embedded with setea	52

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-014	Form No. 0014	**0038**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	-

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	-
7.2	Basic description of lamella	-

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	-
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	6
9.2	No. of inter-segmental discs	2 (2 x 36mm, 2 x 21mm diameter)
9.3	No. of intra-segmental discs	2 (36mm diameter)

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	-
11.3	No. of cavities visible	-

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-015	Form No. 0015	**0039**

1.0	Date	10/06/07	
1.1	Completion date	15/07/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	14	
1.4	Weight (g)	35	
1.5	Length (mm)	250	
1.6	Width (mm)	212	
1.7	Height (mm)	44	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☑ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	44					
2.5	No. of connections	43					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	2	2				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	2	6		
3.2	Length of tubules (mm)	108/113	56/54/60/80 /107		
3.3	Diameter of tubules (mm)	22.5	15		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	-
5.2	No. of granulate nodules embedded with setea	-

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-015	Form No. 0015	**0040**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	-

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	7
7.2	Basic description of lamella	CONNECTING SECONDARY TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☐
8.1	Total no. of setae	36 (not in granulate nodules)
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 4-7mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	-
9.2	No. of inter-segmental discs	-
9.3	No. of intra-segmental discs	-

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	2

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-016	Form No. 0016	**0041**

1.0	Date	10/06/07
1.1	Completion date	15/07/05
1.2	Completion day	FRIDAY
1.3	Days since last object completed	0
1.4	Weight (g)	42
1.5	Length (mm)	326
1.6	Width (mm)	204
1.7	Height (mm)	75

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	46					
2.5	No. of connections	45					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	2	3				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	1	5	1
3.2	Length of tubules (mm)	94	107	79/104/111/ 122/144	12
3.3	Diameter of tubules (mm)	26	19	16	6

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	-
5.2	No. of granulate nodules embedded with setea	-

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-016	Form No. 0016	**0042**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	-

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	6
7.2	Basic description of lamella	CONNECTING TERTIARY TUBULES AND ENDS OF PRIMARY AND SECONDARY TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	38 (not embedded in granulate nodules)
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 5-7mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	2

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-017	Form No. 0017	**0043**

1.0	Date	10/06/07	
1.1	Completion date	29/07/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	14	
1.4	Weight (g)	40	
1.5	Length (mm)	300	
1.6	Width (mm)	195	
1.7	Height (mm)	70	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☑ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	41					
2.5	No. of connections	40					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	4	3	2			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	1	5	4
3.2	Length of tubules (mm)	58	112	60/67/104/ 109/153	33/38/40/55
3.3	Diameter of tubules (mm)	26	24	16	13

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	-
5.2	No. of granulate nodules embedded with setea	-

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-017	Form No. 0017	**0044**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	-

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	10
7.2	Basic description of lamella	ON JOINS AND ENDS

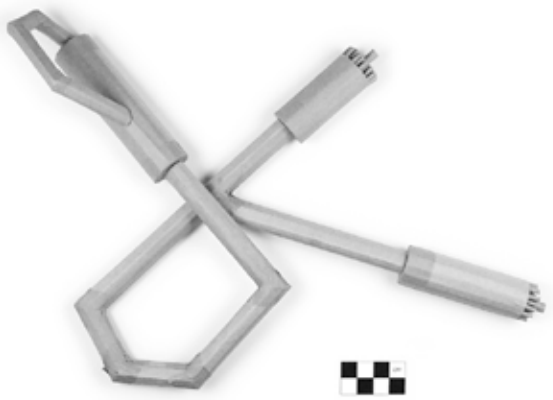
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	29
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 4-7mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	2			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	33/40			
10.6	Diameter of branches (mm)	13			
10.7	Position of branches	OFF PRIMARY TUBULE			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-018	Form No. 0018	**0045**

1.0	Date	10/06/07	
1.1	Completion date	05/08/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	7	
1.4	Weight (g)	48	
1.5	Length (mm)	365	
1.6	Width (mm)	240	
1.7	Height (mm)	62	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	77					
2.5	No. of connections	77					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	4	3				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	3	6	4	2
3.2	Length of tubules (mm)	54/74/92	53/53/82/99 /120/162	37/36/50/53	15/14
3.3	Diameter of tubules (mm)	25	14	11	5

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-018	Form No. 0018	**0046**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	12
7.2	Basic description of lamella	ENDS OF PRIMARY TUBULES, CONNECTING SECONDARY AND QUATERNARY

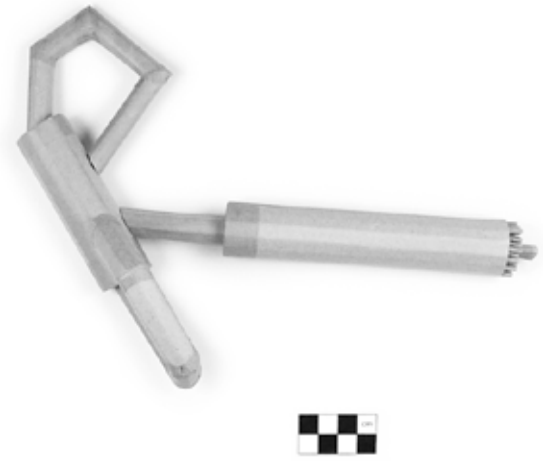
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☑ Absent ☐
8.1	Total no. of setae	62
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 6mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	1	2		
10.4	Angle of branches	60	55/60		
10.5	Length of branches (mm)	120	53/37		
10.6	Diameter of branches (mm)	14	11		
10.7	Position of branches	COMPLEX			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-019	Form No. 0019	**0047**

1.0	Date	10/06/07	
1.1	Completion date	05/08/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	45	
1.5	Length (mm)	240	
1.6	Width (mm)	200	
1.7	Height (mm)	88	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	50					
2.5	No. of connections	51					
2.6	No. of self supporting orientations	4					
2.7	No. of points of surface contact per orientation	2	4	3	3		

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	2	6	4	1
3.2	Length of tubules (mm)	86/138	39/43/40/53 /55/67	35/45/56/63	13
3.3	Diameter of tubules (mm)	28	14	18	7.5

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-019	Form No. 0019	**0048**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	10
7.2	Basic description of lamella	ENDS OF PRIMARY TUBULES, JOINING SECONDARY AND TERTIARY TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☑ Absent ☐
8.1	Total no. of setae	37 (not embedded in granulate nodules)
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 5-7mm

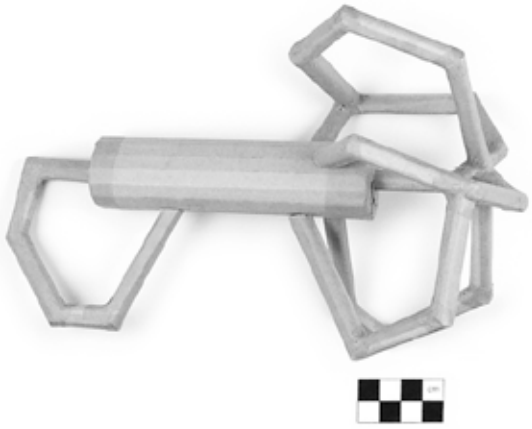
9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	3	2		
10.4	Angle of branches	90/70/60	65/60		
10.5	Length of branches (mm)	38/55/55	46/63		
10.6	Diameter of branches (mm)	14	11		
10.7	Position of branches	OFF SHORT PRIMARY TUBULES			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-020	Form No. 0020	**0049**

1.0	Date	10/06/07
1.1	Completion date	08/08/05
1.2	Completion day	MONDAY
1.3	Days since last object completed	3
1.4	Weight (g)	39
1.5	Length (mm)	235
1.6	Width (mm)	150
1.7	Height (mm)	100



2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	27					
2.5	No. of connections	27					
2.6	No. of self supporting orientations	5					
2.7	No. of points of surface contact per orientation	3	3	3	3	3	

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	26		
3.2	Length of tubules (mm)	121	26-65		
3.3	Diameter of tubules (mm)	35	11		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-020	Form No. 0020	**0050**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	25
7.2	Basic description of lamella	ENDS OF PRIMARY TUBULES, JOINING SECONDARY TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	11			
10.4	Angle of branches	60-90			
10.5	Length of branches (mm)	26-65			
10.6	Diameter of branches (mm)	35			
10.7	Position of branches	7 OFF PRIMARY TUBULE, 4 OFF SECONDARY TUBULE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-021	Form No. 0021	**0051**

1.0	Date	12/06/07	
1.1	Completion date	19/08/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	11	
1.4	Weight (g)	47	
1.5	Length (mm)	345	
1.6	Width (mm)	91	
1.7	Height (mm)	80	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	79					
2.5	No. of connections	92					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	2			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	1	1	2	
3.2	Length of tubules (mm)	110	140	73/95	
3.3	Diameter of tubules (mm)	33	19.5	17	

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☑ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
5.1	Total no. of granulate nodules	21
5.2	No. of granulate nodules embedded with setea	21 (intersecting setae)

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-021	Form No. 0021	**0052**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	4
7.2	Basic description of lamella	ENDS OF TUBULES, FACE OF INTRA –SEGMENTAL DISC

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☑ Absent ☐
8.1	Total no. of setae	50
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 9-100mm

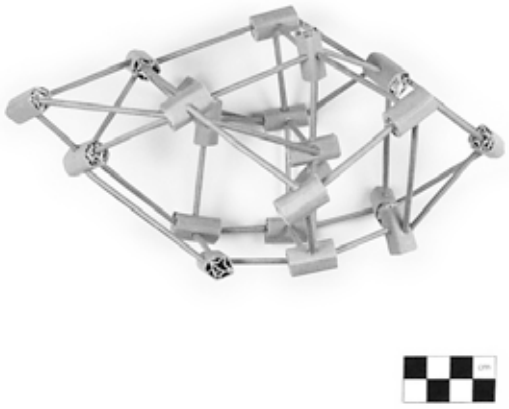
9.0	**Segmental discs**	Inter ☑ Intra ☑ Non-segmental ☐ Absent ☐
9.1	Total no. of discs	3
9.2	No. of inter-segmental discs	2
9.3	No. of intra-segmental discs	1

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	1	50		
10.4	Angle of branches	45	15-90		
10.5	Length of branches (mm)	73			
10.6	Diameter of branches (mm)	17			
10.7	Position of branches	OFF SECONDARY TUBULE			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN
11.3	No. of cavities visible	1

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-022	Form No. 0022	**0053**

1.0	Date	12/06/07
1.1	Completion date	02/09/05
1.2	Completion day	FRIDAY
1.3	Days since last object completed	13
1.4	Weight (g)	9
1.5	Length (mm)	210
1.6	Width (mm)	104
1.7	Height (mm)	96



2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	63					
2.5	No. of connections	90					
2.6	No. of self supporting orientations	4					
2.7	No. of points of surface contact per orientation	3	3	3	3		

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	20			
3.2	Length of tubules (mm)	19			
3.3	Diameter of tubules (mm)	9.5			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-022	Form No. 0022	**0054**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

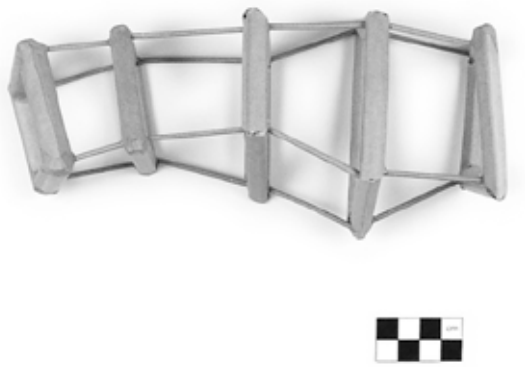
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	43
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 5-60mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	90			
10.4	Angle of branches	variable			
10.5	Length of branches (mm)	5-60			
10.6	Diameter of branches (mm)	2.5			
10.7	Position of branches	SETAE OFF PRIMARY TUBULES			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	40

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-023	Form No. 0023	**0055**

1.0	Date	12/06/07	
1.1	Completion date	05/09/05	
1.2	Completion day	MONDAY	
1.3	Days since last object completed	3	
1.4	Weight (g)	23	
1.5	Length (mm)	200	
1.6	Width (mm)	102	
1.7	Height (mm)	75	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	36					
2.5	No. of connections	52					
2.6	No. of self supporting orientations	5					
2.7	No. of points of surface contact per orientation	3	3	4	3	3	

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	20			
3.2	Length of tubules (mm)	45-100			
3.3	Diameter of tubules (mm)	11			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-023	Form No. 0023	**0056**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	9
7.2	Basic description of lamella	ON OUTSIDE CORNERS OF 9 OUT OF 20 JOINS OF PRIMARY TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	16
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 23-50

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	32			
10.4	Angle of branches	70-120			
10.5	Length of branches (mm)	23-50			
10.6	Diameter of branches (mm)	2.5			
10.7	Position of branches	JOINING PRIMARY TUBULES			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-024	Form No. 0024	**0057**

1.0	Date	12/06/07
1.1	Completion date	09/09/05
1.2	Completion day	FRIDAY
1.3	Days since last object completed	4
1.4	Weight (g)	19
1.5	Length (mm)	175
1.6	Width (mm)	110
1.7	Height (mm)	120

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	15					
2.5	No. of connections	15					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	3	3	3	3	3	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	15			
3.2	Length of tubules (mm)	35-102			
3.3	Diameter of tubules (mm)	11			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-024	Form No. 0024	**0058**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	4
7.2	Basic description of lamella	JOINING CENTRAL TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	11			
10.4	Angle of branches	35-140			
10.5	Length of branches (mm)	35-102			
10.6	Diameter of branches (mm)	11			
10.7	Position of branches	RADIAL, AROUND CENTRAL TUBULES			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE
11.3	No. of cavities visible	11

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-025	Form No. 0025	**0059**

1.0	Date	12/06/07
1.1	Completion date	10/09/05
1.2	Completion day	SATURDAY
1.3	Days since last object completed	1
1.4	Weight (g)	40
1.5	Length (mm)	200
1.6	Width (mm)	170
1.7	Height (mm)	168

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	28					
2.5	No. of connections	28					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	3	3	3	3	3	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	5	23		
3.2	Length of tubules (mm)	38-100	47-107		
3.3	Diameter of tubules (mm)	17	12		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-025	Form No. 0025	**0060**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	5
7.2	Basic description of lamella	ON JOINS ON CENTRAL TUBULAR STRUCTURE

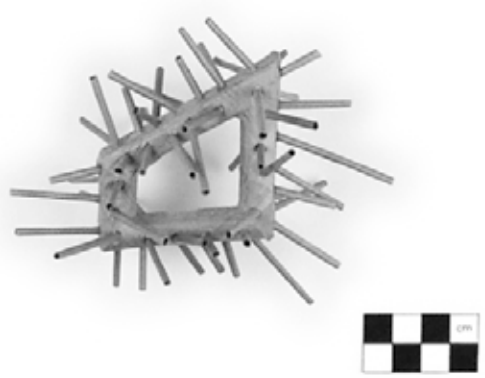
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	23			
10.4	Angle of branches	30-130			
10.5	Length of branches (mm)	47-107			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches	RADIAL, OFF CENTRAL STRUCTURE			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	23

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-026	Form No. 0026	**0061**

1.0	Date	12/06/07	
1.1	Completion date	10/09/05	
1.2	Completion day	SATURDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	8	
1.5	Length (mm)	115	
1.6	Width (mm)	105	
1.7	Height (mm)	80	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	60					
2.5	No. of connections	60					
2.6	No. of self supporting orientations	6+					
2.7	No. of points of surface contact per orientation	3	4	3	3	4	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	4			
3.2	Length of tubules (mm)	33/57/60/67			
3.3	Diameter of tubules (mm)	11.5			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-026	Form No. 0026	**0062**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	4
7.2	Basic description of lamella	AROUND JOINS OF CENTRAL STRUCTURE

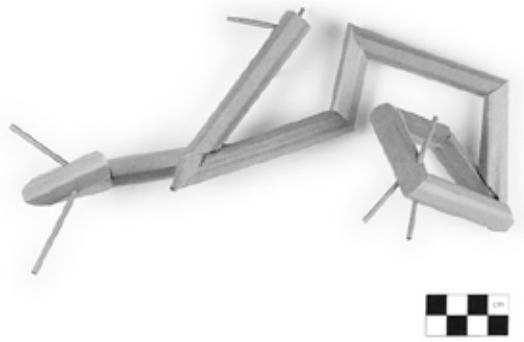
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	56
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 11-32mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	56			
10.4	Angle of branches	40-140			
10.5	Length of branches (mm)	11-32			
10.6	Diameter of branches (mm)	2.5			
10.7	Position of branches	RADIATING AROUND CENTRAL STRUCTURE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-027	Form No. 0027	**0063**

1.0	Date	12/06/07	
1.1	Completion date	21/10/05	
1.2	Completion day	WEDNESDAY	
1.3	Days since last object completed	11	
1.4	Weight (g)	23	
1.5	Length (mm)	220	
1.6	Width (mm)	128	
1.7	Height (mm)	74	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	20					
2.5	No. of connections	25					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	4			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	13			
3.2	Length of tubules (mm)	15-93			
3.3	Diameter of tubules (mm)	14			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-027	Form No. 0027	**0064**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

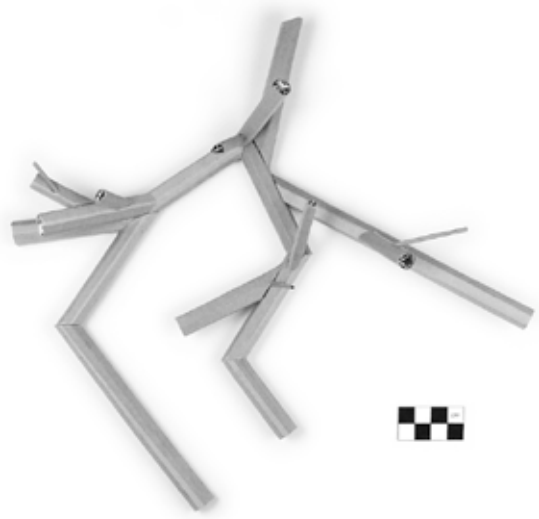
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	7
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 21-42

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	7			
10.4	Angle of branches	60-70			
10.5	Length of branches (mm)	21-42			
10.6	Diameter of branches (mm)	2.5			
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE
11.3	No. of cavities visible	2

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-028	Form No. 0028	**0065**

1.0	Date	12/06/07	
1.1	Completion date	21/10/05	
1.2	Completion day	WEDNESDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	34	
1.5	Length (mm)	310	
1.6	Width (mm)	292	
1.7	Height (mm)	65	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	21					
2.5	No. of connections	22					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	3	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	11	3	3	
3.2	Length of tubules (mm)	41-174	41/60/39	30/42/44	
3.3	Diameter of tubules (mm)	19	12	7	

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-028	Form No. 0028	**0066**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

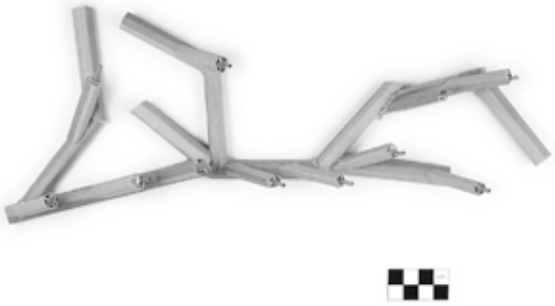
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	3
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 22-46

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	5	3	3	
10.4	Angle of branches	35-150	45-135	130	
10.5	Length of branches (mm)	72-174	39/41/60	30/42/44	
10.6	Diameter of branches (mm)	19	12	7	
10.7	Position of branches	RADIAL			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	13

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-029	Form No. 0029	**0067**

1.0	Date	14/06/07	
1.1	Completion date	21/10/05	
1.2	Completion day	WEDNESDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	39	
1.5	Length (mm)	355	
1.6	Width (mm)	128	
1.7	Height (mm)	47	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	33					
2.5	No. of connections	32					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	4	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	11	11		
3.2	Length of tubules (mm)	62-133	40-45		
3.3	Diameter of tubules (mm)	13	10		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-029	Form No. 0029	**0068**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☐ Vertical ☑
6.2	Total no. of striations	10 (AROUND JOINS OF PRIMARY TUBULES)

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	11
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 8mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	5	11		
10.4	Angle of branches	30-140	40-50		
10.5	Length of branches (mm)	62-133	40-45		
10.6	Diameter of branches (mm)	13	10		
10.7	Position of branches	PRIMARY BRANCHES = HORIZONTAL, SECONDARY BRANCHES = VERTICAL			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	BROWN/WHITE
11.3	No. of cavities visible	18

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-030	Form No. 0030	**0069**

1.0	Date	14/06/07
1.1	Completion date	22/10/05
1.2	Completion day	THURSDAY
1.3	Days since last object completed	1
1.4	Weight (g)	50
1.5	Length (mm)	235
1.6	Width (mm)	160
1.7	Height (mm)	73

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	59					
2.5	No. of connections	60					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	4	4	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	59			
3.2	Length of tubules (mm)	13			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-030	Form No. 0030	**0070**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☑ Vertical ☐
6.2	Total no. of striations	54

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	13			
10.4	Angle of branches	25-100			
10.5	Length of branches (mm)	65-75			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	16

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-031	Form No. 0031	**0071**

1.0	Date	14/06/07
1.1	Completion date	28/10/05
1.2	Completion day	WEDNESDAY
1.3	Days since last object completed	6
1.4	Weight (g)	52
1.5	Length (mm)	325
1.6	Width (mm)	158
1.7	Height (mm)	53

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	51					
2.5	No. of connections	46					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	4			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	51			
3.2	Length of tubules (mm)	13-18			
3.3	Diameter of tubules (mm)	14.5			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-031	Form No. 0031	**0072**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☐ Vertical ☑
6.2	Total no. of striations	50

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	11			
10.4	Angle of branches	80-90			
10.5	Length of branches (mm)	35-145			
10.6	Diameter of branches (mm)	14.5			
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	13

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-032	Form No. 0032	**0073**

1.0	Date	14/06/07	
1.1	Completion date	29/10/05	
1.2	Completion day	THURSDAY	
1.3	Days since last object completed	1	
1.4	Weight (g)	43	
1.5	Length (mm)	235	
1.6	Width (mm)	150	
1.7	Height (mm)	53	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	43					
2.5	No. of connections	41					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	43			
3.2	Length of tubules (mm)	15-22			
3.3	Diameter of tubules (mm)	14.5			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-032	Form No. 0032	**0074**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☑ Vertical ☐
6.2	Total no. of striations	41

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	4	11		
10.4	Angle of branches	90	90		
10.5	Length of branches (mm)	70-115	15-22		
10.6	Diameter of branches (mm)	14.5	14.5		
10.7	Position of branches	APPROXIMATELY PERPENDICULAR			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	18

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-033	Form No. 0033	**0075**

1.0	Date	14/06/07	
1.1	Completion date	29/10/05	
1.2	Completion day	THURSDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	52	
1.5	Length (mm)	190	
1.6	Width (mm)	165	
1.7	Height (mm)	115	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	52					
2.5	No. of connections	43					
2.6	No. of self supporting orientations	5					
2.7	No. of points of surface contact per orientation	3	3	3	3	3	

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	52			
3.2	Length of tubules (mm)	11-22			
3.3	Diameter of tubules (mm)	14.5			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-033	Form No. 0033	**0076**

6.0	**Striations**	Continuous ☑ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☑ Vertical ☑
6.2	Total no. of striations	104

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

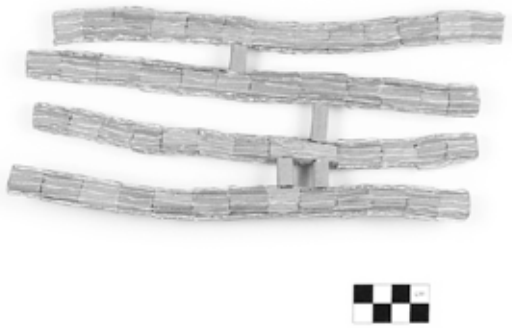
9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	10			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	70-80			
10.6	Diameter of branches (mm)	14.5			
10.7	Position of branches	PERPENDICULAR			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	10

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-034	Form No. 0034	**0077**

1.0	Date	15/06/07
1.1	Completion date	29/10/05
1.2	Completion day	THURSDAY
1.3	Days since last object completed	0
1.4	Weight (g)	48
1.5	Length (mm)	252
1.6	Width (mm)	110
1.7	Height (mm)	123



2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	55					
2.5	No. of connections	55					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	3	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	51	4		
3.2	Length of tubules (mm)	11-19	11-21		
3.3	Diameter of tubules (mm)	16	9		

4.0	**Surface Characteristics**	Smooth ☐ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-034	Form No. 0034	**0078**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☑ Vertical ☐
6.2	Total no. of striations	APPROXIMATELY 12 PER TUBULE

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

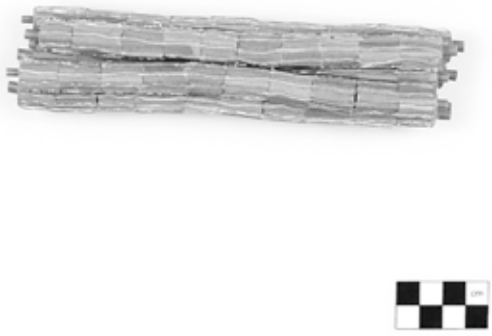
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	4			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	11-21			
10.6	Diameter of branches (mm)	9			
10.7	Position of branches	JOINING PRIMARY TUBULES			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	WHITE/PINK/BROWN
11.3	No. of cavities visible	8

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-035	Form No. 0035	**0079**

1.0	Date	15/06/07	
1.1	Completion date	18/11/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	50	
1.4	Weight (g)	57	
1.5	Length (mm)	190	
1.6	Width (mm)	40	
1.7	Height (mm)	40	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☑ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	84					
2.5	No. of connections	95					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	3	4	3	3	3	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	70			
3.2	Length of tubules (mm)	11-19			
3.3	Diameter of tubules (mm)	13			

4.0	**Surface Characteristics**	Smooth ☐ Granulated ☐ Striated ☑

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-035	Form No. 0035	**0080**

6.0	**Striations**	Continuous ☑ Terminal ☐ Basal ☑ Absent ☐
6.1	Orientation of striations	Horizontal ☑ Vertical ☐
6.2	Total no. of striations	APPROX. 70 (8-9 PER TUBULE)

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

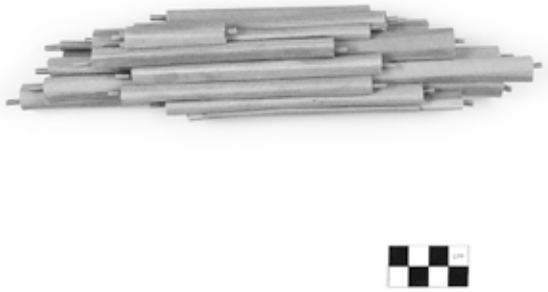
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	14
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 5-7mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	14

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-036	Form No. 0036	**0081**

1.0	Date	15/06/07	
1.1	Completion date	18/11/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	63	
1.5	Length (mm)	258	
1.6	Width (mm)	50	
1.7	Height (mm)	47	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	56					
2.5	No. of connections	55					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	2	2	2	2	2	2

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	4	8	6	
3.2	Length of tubules (mm)	158-232	45-163	91-157	
3.3	Diameter of tubules (mm)	13.5	10	7	

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-036	Form No. 0036	**0082**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☐ Absent ☑
7.1	Total no. of lamella pieces	
7.2	Basic description of lamella	

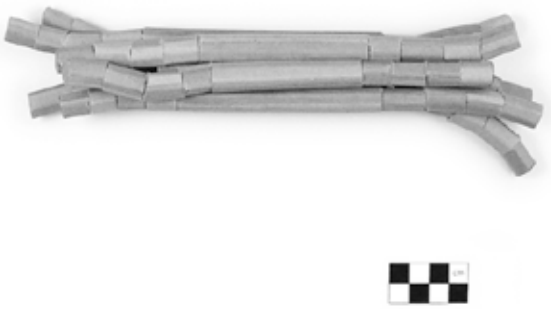
8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☑ Absent ☐
8.1	Total no. of setae	38 (plus 2 long - 8mm diameter, 38mm and 100mm long)
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 7-8mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	BROWN/WHITE/PINK
11.3	No. of cavities visible	36

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-037	Form No. 0037	**0083**

1.0	Date	16/06/07	
1.1	Completion date	18/11/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	46	
1.5	Length (mm)	265	
1.6	Width (mm)	80	
1.7	Height (mm)	48	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	55					
2.5	No. of connections	68					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	4	3	4			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	7	48		
3.2	Length of tubules (mm)	70-160	15-21		
3.3	Diameter of tubules (mm)	13	13		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-037	Form No. 0037	**0084**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	14
7.2	Basic description of lamella	CIRCLES ON ENDS OF PRIMARY TUBULES

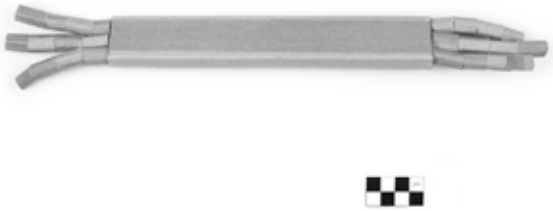
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-038	Form No. 0038	**0085**

1.0	Date	16/06/07	
1.1	Completion date	19/11/05	
1.2	Completion day	SATURDAY	
1.3	Days since last object completed	1	
1.4	Weight (g)	27	
1.5	Length (mm)	365	
1.6	Width (mm)	45	
1.7	Height (mm)	37	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☐ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	25					
2.5	No. of connections	24					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	3	3				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	24			
3.2	Length of tubules (mm)	13-22			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-038	Form No. 0038	**0086**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	8
7.2	Basic description of lamella	STRIPS ON CENTRE, CIRCLES ON ENDS OF TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	6			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	80			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches	ON OPPOSITE ENDS OF CENTRAL RECTILINEAR FORM			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-039	Form No. 0039	**0087**

1.0	Date	16/06/07	
1.1	Completion date	19/11/05	
1.2	Completion day	SATURDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	48	
1.5	Length (mm)	360	
1.6	Width (mm)	85	
1.7	Height (mm)	95	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☐ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	53					
2.5	No. of connections	52					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	52			
3.2	Length of tubules (mm)	10-21			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-039	Form No. 0039	**0088**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	13
7.2	Basic description of lamella	CIRCLES ON ENDS OF PRIMARY TUBULES

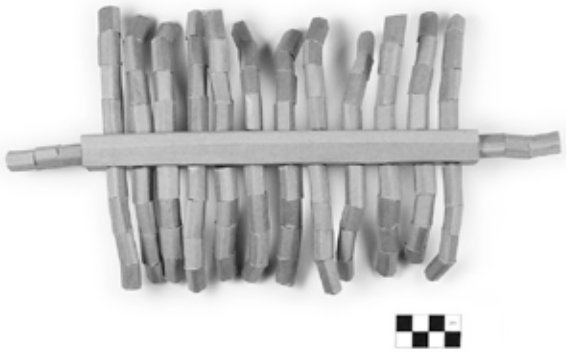
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	13			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	80			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches	ON OPPOSITE ENDS OF CENTRAL RECTILINEAR FORM			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-040	Form No. 0040	**0089**

1.0	Date	16/06/07	
1.1	Completion date	25/11/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	6	
1.4	Weight (g)	77	
1.5	Length (mm)	325	
1.6	Width (mm)	170	
1.7	Height (mm)	53	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☑ Complex ☐					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☐ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	166					
2.5	No. of connections	165					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	5	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	165			
3.2	Length of tubules (mm)	10-21			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-040	Form No. 0040	**0090**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	28
7.2	Basic description of lamella	SEALING ENDS OF CENTRAL TUBE AND ON ENDS OF PRIMARY TUBULES

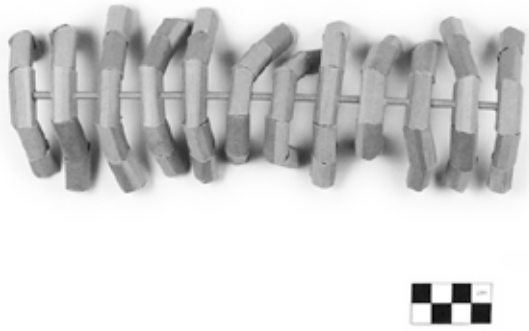
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	98			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	80			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches	PERPENDICULAR TO CENTRAL FORM			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-041	Form No. 0041	**0091**

1.0	Date	16/06/07	
1.1	Completion date	25/11/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	41	
1.5	Length (mm)	240	
1.6	Width (mm)	87	
1.7	Height (mm)	48	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☑ Axial ☐ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	71					
2.5	No. of connections	81					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	5	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	60			
3.2	Length of tubules (mm)	10-21			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-041	Form No. 0041	**0092**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	24
7.2	Basic description of lamella	CIRCLES ON END OF TUBULES

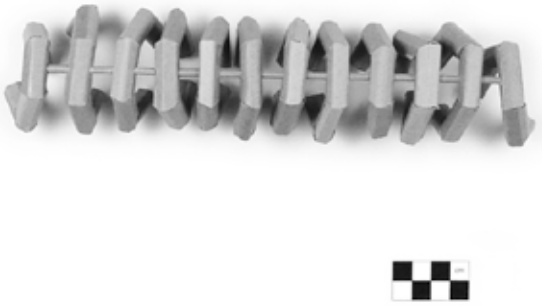
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	11 (DIAMETER 3.5mm)
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-042	Form No. 0042	**0093**

1.0	Date	16/06/07	
1.1	Completion date	09/12/05	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	14	
1.4	Weight (g)	45	
1.5	Length (mm)	275	
1.6	Width (mm)	60	
1.7	Height (mm)	45	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☑ Radial ☐ Axial ☑ Asymmetrical ☐					
2.4	No. of discrete/connecting parts	71					
2.5	No. of connections	81					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	5	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	60			
3.2	Length of tubules (mm)	10-21			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-042	Form No. 0042	**0094**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	26
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES

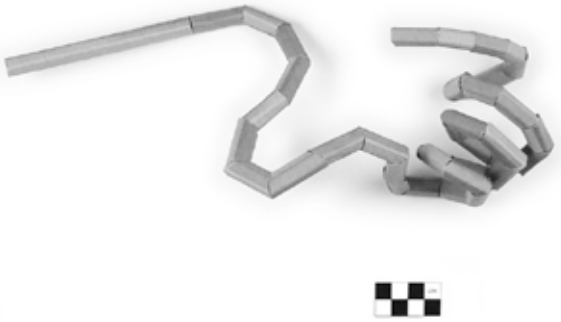
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	11
8.2	Length of setae	Standard (1cm) ☑ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-043	Form No. 0043	**0095**

1.0	Date	16/06/07	
1.1	Completion date	20/01/06	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	42	
1.4	Weight (g)	34	
1.5	Length (mm)	305	
1.6	Width (mm)	135	
1.7	Height (mm)	78	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	38					
2.5	No. of connections	37					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	3	4				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	38			
3.2	Length of tubules (mm)	22 - 110			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-043	Form No. 0043	**0096**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	2
7.2	Basic description of lamella	CIRCLES ON ENDS

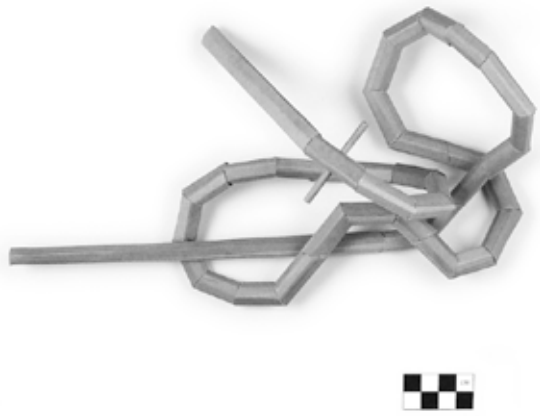
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☐ Absent ☑			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations				
10.4	Angle of branches				
10.5	Length of branches (mm)				
10.6	Diameter of branches (mm)				
10.7	Position of branches				

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-044	Form No. 0044	**0097**

1.0	Date	16/06/07	
1.1	Completion date	24/01/05	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	4	
1.4	Weight (g)	40	
1.5	Length (mm)	284	
1.6	Width (mm)	150	
1.7	Height (mm)	104	

2.0	**Basic Morphology**	Linear ☑ Branched ☐ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	39					
2.5	No. of connections	38					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	4			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	37			
3.2	Length of tubules (mm)	22-205			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-044	Form No. 0044	**0098**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	4
7.2	Basic description of lamella	CIRCLES ON ENDS OF PRIMARY TUBULES AND SETAE

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	2
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 18mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	2			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	18			
10.6	Diameter of branches (mm)	4			
10.7	Position of branches	SETAE OFF PRIMARY TUBULE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-045	Form No. 0045	**0099**

1.0	Date	16/06/07	
1.1	Completion date	27/01/07	
1.2	Completion day	FRIDAY	
1.3	Days since last object completed	3	
1.4	Weight (g)	30	
1.5	Length (mm)	222	
1.6	Width (mm)	190	
1.7	Height (mm)	65	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☑ Curved ☑					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	30					
2.5	No. of connections	29					
2.6	No. of self supporting orientations	2					
2.7	No. of points of surface contact per orientation	3	3				

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	24			
3.2	Length of tubules (mm)	20-144			
3.3	Diameter of tubules (mm)	12			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-045	Form No. 0099	**0100**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	9
7.2	Basic description of lamella	CIRCLES ON ENDS OF PRIMARY TUBULES AND SETAE

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	6
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 14-22mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	6			
10.4	Angle of branches	90			
10.5	Length of branches (mm)	14-22			
10.6	Diameter of branches (mm)	4			
10.7	Position of branches	SETAE OFF PRIMARY TUBULES			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-046	Form No. 0046	**0101**

1.0	Date	16/06/07
1.1	Completion date	31/01/06
1.2	Completion day	TUESDAY
1.3	Days since last object completed	4
1.4	Weight (g)	34
1.5	Length (mm)	215
1.6	Width (mm)	180
1.7	Height (mm)	112

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	25					
2.5	No. of connections	24					
2.6	No. of self supporting orientations	4					
2.7	No. of points of surface contact per orientation	3	3	4	3		

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	13	12		
3.2	Length of tubules (mm)	30-160	20-27		
3.3	Diameter of tubules (mm)	13.5	8.5		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-046	Form No. 0046	**0102**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	8
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES

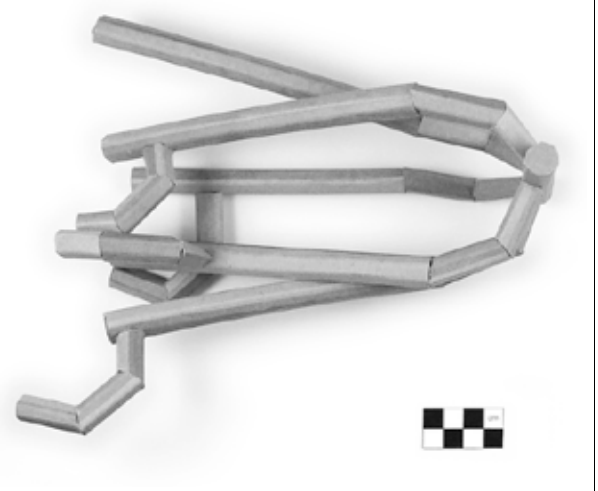
8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	2	4		
10.4	Angle of branches	30-80	90		
10.5	Length of branches (mm)	30-35	20-27		
10.6	Diameter of branches (mm)	13.5	8.5		
10.7	Position of branches	VARIABLE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-047	Form No. 0047	**0103**

1.0	Date	16/06/07	
1.1	Completion date	31/01/06	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	0	
1.4	Weight (g)	53	
1.5	Length (mm)	255	
1.6	Width (mm)	115	
1.7	Height (mm)	135	

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	28					
2.5	No. of connections	27					
2.6	No. of self supporting orientations	3					
2.7	No. of points of surface contact per orientation	3	3	3			

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	6	22		
3.2	Length of tubules (mm)	113-157	19-42		
3.3	Diameter of tubules (mm)	13.5	12		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-047	Form No. 0047	**0104**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	11
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
8.1	Total no. of setae	
8.2	Length of setae	Standard (1cm) ☐ Other ☐ Length =

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	9			
10.4	Angle of branches	35-90			
10.5	Length of branches (mm)	19-42			
10.6	Diameter of branches (mm)	12			
10.7	Position of branches	VARIABLE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-048	Form No. 0048	**0105**

1.0	Date	16/06/07
1.1	Completion date	07/02/06
1.2	Completion day	TUESDAY
1.3	Days since last object completed	7
1.4	Weight (g)	66
1.5	Length (mm)	250
1.6	Width (mm)	170
1.7	Height (mm)	225

2.0	**Basic Morphology**	Linear ☑ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	42					
2.5	No. of connections	41					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	3	4	3	3	4	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	19	14	6	
3.2	Length of tubules (mm)	32-155	34	33	
3.3	Diameter of tubules (mm)	14	11	8.5	

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-048	Form No. 0048	**0106**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	14
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES AND SETAE

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	3
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 20-23 mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	6	5	2	1
10.4	Angle of branches	80-90	90	90	90
10.5	Length of branches (mm)	35-42	34	33	23
10.6	Diameter of branches (mm)	14	11	8.5	4
10.7	Position of branches	VARIABLE			

11.1	**Internal cavities**	Visible ☑ Not Visible ☐
11.2	Colour of internal cavities	PINK/BROWN/WHITE
11.3	No. of cavities visible	2

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-049	Form No. 0049	**0107**

1.0	Date	16/06/07
1.1	Completion date	08/02/06
1.2	Completion day	WEDNESDAY
1.3	Days since last object completed	1
1.4	Weight (g)	42
1.5	Length (mm)	225
1.6	Width (mm)	200
1.7	Height (mm)	155

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	28					
2.5	No. of connections	27					
2.6	No. of self supporting orientations	6					
2.7	No. of points of surface contact per orientation	3	3	2	4	3	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	13	9		
3.2	Length of tubules (mm)	67-120	28-38		
3.3	Diameter of tubules (mm)	15	11		

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-049	Form No. 0049	**0108**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	9
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES AND SETAE

8.0	**Setae**	Continuous ☐ Terminal ☑ Basal ☐ Absent ☐
8.1	Total no. of setae	6
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 18-22mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	3	3	2	
10.4	Angle of branches	60-90	60-90	90	
10.5	Length of branches (mm)	76-85	25-33	25	
10.6	Diameter of branches (mm)	15	11	4	
10.7	Position of branches	VARIABLE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-050	Form No. 0050	**0109**

1.0	Date	16/06/07	
1.1	Completion date	21/02/06	
1.2	Completion day	TUESDAY	
1.3	Days since last object completed	13	
1.4	Weight (g)	54	
1.5	Length (mm)	205	
1.6	Width (mm)	185	
1.7	Height (mm)	185	

2.0	**Basic Morphology**	Linear ☐ Branched ☑ Spiral ☐ Curved ☐					
2.1	Planarity	Simple ☐ Complex ☑					
2.2	Segmentation	Present ☑ Absent ☐					
2.3	Symmetry	Bilateral ☐ Radial ☐ Axial ☐ Asymmetrical ☑					
2.4	No. of discrete/connecting parts	25					
2.5	No. of connections	24					
2.6	No. of self supporting orientations	6+					
2.7	No. of points of surface contact per orientation	3	2	3	3	3	3

3.0	**Tubular parts (tubules)**	Primary	Secondary	Tertiary	Quaternary
3.1	No. of tubules	21			
3.2	Length of tubules (mm)	40-165			
3.3	Diameter of tubules (mm)	13			

4.0	**Surface Characteristics**	Smooth ☑ Granulated ☐ Striated ☐

5.0	**Granulate nodules**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
5.1	Total no. of granulate nodules	
5.2	No. of granulate nodules embedded with setea	

Missing Links Data Collection		MORPHOLOGICAL ANALYSIS
Object No. 2-050	Form No. 0050	**0110**

6.0	**Striations**	Continuous ☐ Terminal ☐ Basal ☐ Absent ☑
6.1	Orientation of striations	Horizontal ☐ Vertical ☐
6.2	Total no. of striations	

7.0	**Epidermal layer lamella**	Present ☑ Absent ☐
7.1	Total no. of lamella pieces	11
7.2	Basic description of lamella	CIRCLES ON ENDS OF TUBULES AND SETAE

8.0	**Setae**	Continuous ☐ Terminal ☐ Basal ☑ Absent ☐
8.1	Total no. of setae	4
8.2	Length of setae	Standard (1cm) ☐ Other ☑ Length = 25-33mm

9.0	**Segmental discs**	Inter ☐ Intra ☐ Non-segmental ☐ Absent ☑
9.1	Total no. of discs	
9.2	No. of inter-segmental discs	
9.3	No. of intra-segmental discs	

10.1	**Branching**	Present ☑ Absent ☐			
10.2	Branches	Primary	Secondary	Tertiary	Quaternary
10.3	No. of bifurcations	7	2		
10.4	Angle of branches	80-90	80-90		
10.5	Length of branches (mm)	40-150	25-35		
10.6	Diameter of branches (mm)	13	4		
10.7	Position of branches	VARIABLE			

11.1	**Internal cavities**	Visible ☐ Not Visible ☑
11.2	Colour of internal cavities	
11.3	No. of cavities visible	

GLOSSARY of useful terms

- **Acuminate:** tapering gradually to a point
- **Acute:** sharp, pointed
- **Adnate:** joined together
- **Adpressed:** closely pressed together but not united
- **Aggregate:** densely clustered
- **Ankylosed:** grown firmly together
- **Anterior:** relating to the front portion
- **Antrose:** turned forward
- **Apical:** tip
- **Applanate:** flattened
- **Approximate:** placed close together
- **Asperity:** roughness of surface
- **Asymmetrical:** without symmetry
- **Attenuate:** tapering to a point, usually in reference to a tail
- **Axial Symmetry:** front and back halves are approximate mirror images, an imaginary axis running antero-posteriorly through the middle of a structure.

- **Basal:** pertaining to the base, at the base
- **Base:** the part of a projection, (commonly a fin), which is connected to the body
- **Bicuspid:** having two cusps or points
- **Bifid:** cleft in two
- **Bifurcate:** forked, or divided into two parts or branches
- **Bilateral:** right and left halves of a structure are approximate mirror images of each other
- **Branched:** divided and separated, an offshoot or a division of the main portion of a structure
- **Bristle:** a stiff hair-like projection

- **Carinate:** keeled, having a ridge along the middle line
- **Caudal:** posterior end
- **Ciliated:** fringed with lash-like projections
- **Cirri:** small, thin appendages, often subdivided into branches.
- **Cirrus:** singular of cirri (see above)
- **Compressed:** flattened laterally
- **Confluent:** joined together
- **Conical:** cone shaped, with a cylindrical base and a pointed tip
- **Ctenoid:** rough-edged
- **Cycloid:** smooth-edged

- **Deciduous:** temporary, falling off
- **Deltoid:** roughly triangular in shape
- **Dendritic:** resembling a tree or shrub
- **Depressed:** flattened from top to bottom
- **Dichotomous:** branching regularly and repeatedly in pairs
- **Diffuse:** loosely branching or spreading
- **Digitate:** radiating from a common point
- **Disc:** a flattened cylinder or plate
- **Distal:** remote from the point of attachment
- **Divergent:** spreading
- **Dorsal:** pertaining to the back
- **Dorsum:** the upper (dorsal) surface of a structure

- **Elongate:** extended, drawn out, many times longer than broad
- **Epidermal:** pertaining to the epidermis, the outermost layer of a surface

- **Falcate:** scythe-shaped, long, narrow, and curved
- **Falciform:** curved like a scythe
- **Filament:** a slender or thread-like structure
- **Filiform:** thread-like
- **Fimbriate:** fringed at the margin
- **Furcate:** forked
- **Fusiform:** tapering towards both ends, thickest in the middle, spindle shaped

- **Globose:** globe shaped, spherical
- **Glomerate:** compactly clustered
- **Granulate:** finely beaded or noduled. having a rough surface of grainlike elevations.

- **Helicoid**: coiled spirally, like a spring
- **Homology:** similarity of features based on common evolutionary descent
- **Humifuse:** spreading along, over the ground
- **Humistrate:** lying on the ground
- **Hyaline:** translucent or transparent

- **Imbricate:** overlapping, like the shingles on a roof
- **Incised:** with a notched margin (often referring to fin membranes)
- **Inferior:** pertaining to the lower side
- **Infundibular:** funnel shaped
- **Interrupted:** not continuous, with gaps

- **Juxtaposed:** placed near together

- **Lamella**: a thin plate-like part, layer or structure.
- **Lanceolate:** spear-shaped, gradually tapering toward the extremity
- **Lateral:** at or toward the side
- **Lunate:** shaped like a crescent moon, with long upper and lower lobes

- **Median, medially:** pertaining to the middle
- **Mediolateral:** between the middle and the sides
- **Morphology:** form and structure of an organism

- **Nodule**: a small mass of rounded or irregular shape, small abnormal knobbly protuberanc

- **Obsolete:** faintly marked, scarcely evident
- **Obtuse:** blunt
- **Ovate:** egg-shaped

- **Posterior** towards the caudal or hind end
- **Protractile:** capable of extending forward
- **Protrusible:** capable of extending forward
- **Proximal:** nearest

- **Retrose:** turned backward
- **Rugose:** rough

- **Segmented:** divided into similar, repeated sections or units
- **Seriate**: arranged in rows or series
- **Serrate:** notched like a saw
- **Setae:** bristles or hairs
- **Spatulate:** shovel-like; having a broad, flat and rounded shape
- **Spine:** a sharp projecting point
- **Spinous, spiniform, spinate:** spine-like or composed of spines
- **Striated:** marked with stripes, striae, grooves, or ridges
- **Submarginal:** almost at the edge
- **Superior:** above or on the upper surface
- **Supralateral:** above the side
- **Suture:** the line of union of two bones or plates
- **Symmetrical:** similarly arranged on both sides
- **Symbiosis:** used to describe any association between two organisms

- **Terminal:** at the end
- **Terrate:** in threes
- **Tessellated:** marked with little checks or squares, like tiles
- **Transverse:** crosswise
- **Triad:** cluster of three
- **Trilobate:** with three lobes
- **Tricuspid:** with three cusps or points
- **Truncate:** terminating abruptly, as if cut off square
- **Tubercle:** a small, usually hard excrescence or lump
- **Tubiform, Tubuliform:** resembling a tube
- **Tubule:** small tube

- **Undulated:** waved
- **Uniform:** consistent, undifferentiated

- **Ventral:** pertaining to the underside or lower surface
- **Vestigial:** reduced or very poorly developed

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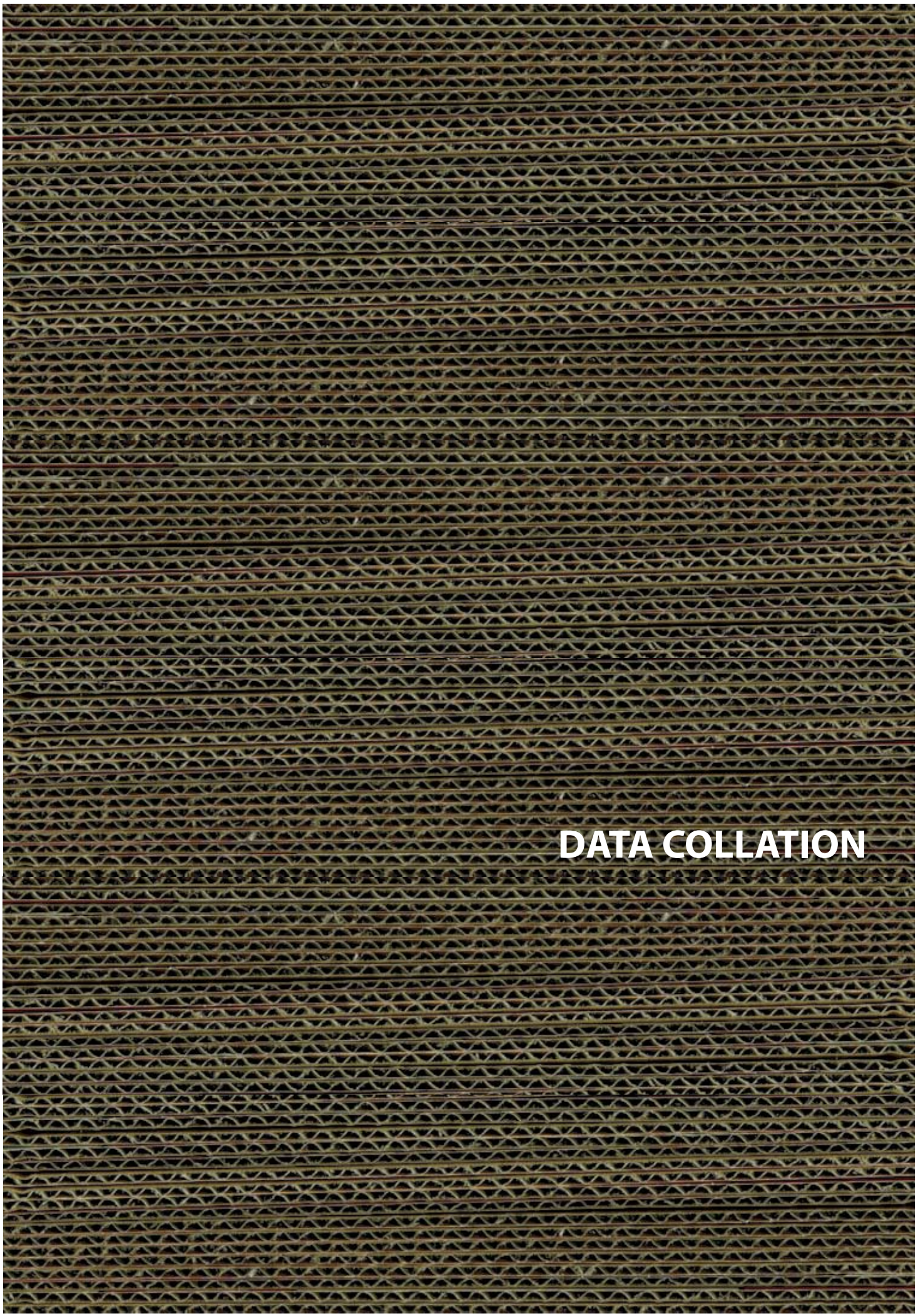

DATA COLLATION

A series of tables and figures were developed to collect and collate data from the Morphological Analysis forms. These include:

DATA COLLATION

FIGURE 1 - Numbering system used for research series objects on Morphological Analysis forms (Objects in construction order)

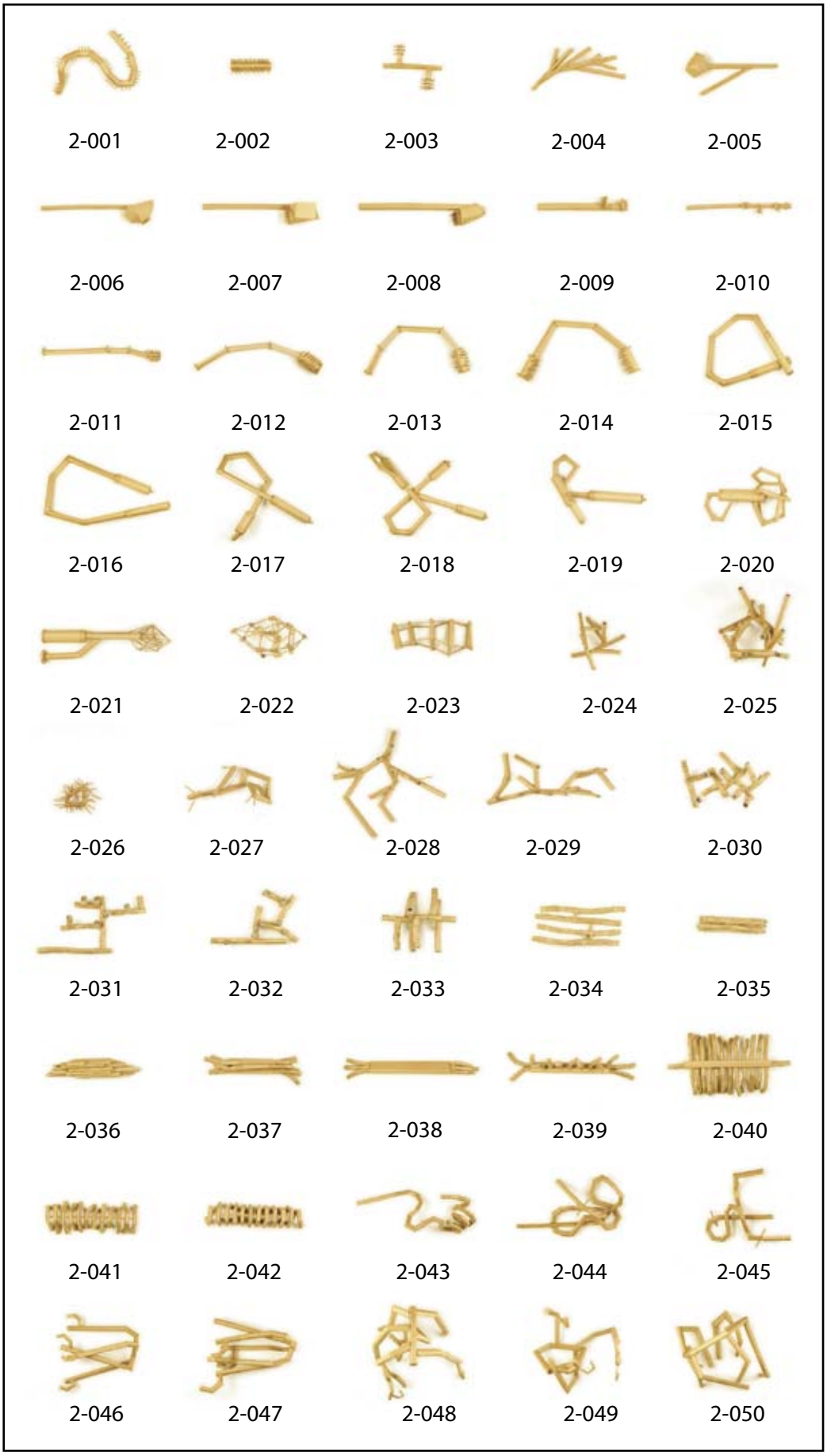


TABLE 1 - Selected Features of Objects 1 - 10

Test data for dichotomous key for objects 1-10

FEATURE	DESCRIPTION	OBJECTS
Segmentation	Segmented Non segmented	1 2,3,4,5,6,7,8,9,10
Branching	Branched Non branched	3,4,5 1,2,6,7,8,9,10
Symmetry	Symmetrical Asymmetrical	2 1,3,4,5,6,7,8,9,10
Internal cavities	Brown Not brown	1,2,3,4,5,6,7,8,10 9
No. of connections between parts	< number of parts > number of parts	1,2,3,4,9,10 5,6.7.8
No. of granulate nodules	< 50 > 50	1,3,5,6,7,9,10 2,4,8
Days since last object completed (DLOC)	0-2 >3	6,8,9 2,3,4,5,7,10
Granulate nodules	Embedded tubules present Embedded tubules absent With and without embedded tubules	1,2,3,6,7,8,9,10 4,5 10

TABLE 2 - Selected numerical data for objects 1 - 10

Test data for dichotomous key for objects 1 - 10

Object	DLOC	Weight (g)	Length (mm)	Width (mm)	Height (mm)	No. of parts	No. of connections	No. of self supporting orientations	No. of granulate nodules	Day completed
1	-	24	245	190	59	88	87	2	38	Fri
2	4	10	108	42	42	165	164	11	82	Tues
3	3	10	159	120	34	75	74	3	36	Fri
4	3	20	262	110	259	121	120	3	114	Mon
5	4	15	255	116	75	45	63	4	20	Fri
6	0	13	304	40	60	52	66	4	16	Fri
7	4	22	310	63	55	101	110	4	44	Tues
8	1	15	340	60	47	191	200	2	91	Wed
9	2	15	244	45	46	38	37	2	35	Fri
10	4	10	287	30	34	64	63	3	40	Tues

TABLE 3 : Collation of basic characteristics of objects 1 - 50 PART 1

OBJECT	Day comp	DLOC	Weight grams	Length mm	No. of parts	No. of joins	No. of self support	No. of tubules	Longest tubule	Surface
1	Fri	-	24	245	88	87	2	12	82	SmG
2	Tue	4	10	108	165	164	11	1	108	SmG
3	Fri	3	10	159	75	74	3	3	157	SmG
4	Mon	3	20	262	121	120	3	7	165	SmG
5	Fri	4	15	255	45	63	4	2	193	SmG
6	Fri	0	13	304	52	66	4	1	300	SmG
7	Tue	4	22	310	101	110	4	1	299	SmG
8	Wed	1	19	340	191	200	2	1	305	SmG
9	Fri	1	15	244	38	37	2	1	228	SmG
10	Tue	4	10	287	64	63	3	1	273	SmG
11	Tue	0	14	178	108	107	3	4	173	SmG
12	Fri	10	24	350	82	81	2	4	120	SmG
13	Wed	5	26	295	93	92	2	5	120	SmG
14	Fri	22	39	327	115	114	2	5	120	SmG
15	Fri	14	35	250	44	43	2	8	113	Sm
16	Fri	0	42	326	46	45	2	8	144	Sm
17	Fri	14	40	300	41	40	3	12	153	Sm
18	Fri	7	48	365	77	77	2	15	162	Sm
19	Fri	0	45	240	50	51	4	13	138	Sm
20	Mon	3	39	235	27	27	5	27	121	Sm
21	Fri	11	47	345	79	92	3	4	140	SmG
22	Fri	13	9	210	63	90	4	20	19	Sm
23	Mon	3	23	200	36	52	5	20	100	Sm
24	Fri	4	19	175	15	15	6	15	102	Sm
25	Sat	1	40	200	28	28	6	28	107	Sm
26	Sat	0	8	115	60	60	6+	4	67	Sm
27	Wed	11	23	220	20	25	3	13	93	Sm
28	Wed	0	34	310	21	22	2	17	174	Sm
29	Wed	0	39	355	33	32	3	22	133	SmSt
30	Thurs	1	50	235	59	60	3	59	13	SmSt
31	Wed	6	52	325	51	46	3	51	18	SmSt
32	Thurs	1	43	235	43	41	3	43	22	SmSt
33	Thurs	0	52	190	52	43	5	52	22	SmSt
34	Thurs	0	48	252	55	55	2	55	21	St
35	Fri	50	57	190	84	95	6	70	19	St
36	Fri	0	63	258	56	55	6	17	232	Sm
37	Fri	0	46	265	55	68	3	55	160	Sm
38	Sat	1	27	365	25	24	2	24	22	Sm
39	Sat	0	48	360	53	52	3	52	21	Sm
40	Fri	6	77	325	166	165	2	165	21	Sm
41	Fri	0	41	240	71	81	2	60	21	Sm
42	Fri	14	45	275	71	81	2	60	21	Sm
43	Fri	42	34	305	38	37	2	38	110	Sm
44	Tue	4	40	284	39	38	3	37	205	Sm
45	Fri	3	30	222	30	29	2	24	144	Sm
46	Tue	4	34	215	25	24	4	25	160	Sm
47	Tue	0	53	255	28	27	3	28	157	Sm
48	Tue	7	66	250	42	41	6	39	155	Sm
49	Wed	1	42	225	28	27	6	22	120	Sm
50	Tues	13	54	205	25	24	6+	21	165	Sm

Abbreviations
Day comp = day completed
DLOC = Days Since Last Object Completed
Surface Sm=smooth, G=granulated, St=striated

TABLE 4 : Collation of basic characteristics of objects 1-50 PART 2

OBJECT	No. of striations	No of granulate nodules	No of lamella	No of setae	Setae length mm	No. of disc seg (inter)	No. of disc seg (intra)	No. of branches	No. of internal cavities	Colour internal cavities
1	0	38	11	38	10	0	0	0	2	Br
2	0	82	0	82	10	0	0	0	2	Br
3	0	36	2	36	10	0	0	2	4	Br
4	0	114	2	0	-	0	0	6	8	BrBl
5	0	20	0	0	-	0	0	1	2	BrBl
6	0	16	0	16	10	0	0	0	1	Br
7	0	44	0	44	10	0	0	0	1	Br
8	0	91	0	91	10	0	0	0	1	Br
9	0	35	4	35	10	1	1	0	1	BrW
10	0	40	8	20	10	2	2	0	1	Br
11	0	62	10	28	10	2	3	0	0	-
12	0	73	10	73	10	2	3	0	0	-
13	0	41	0	41	10	2	4	0	0	-
14	0	52	0	52	10	4	2	0	0	-
15	0	0	7	36	4-7	0	0	0	2	Br
16	0	0	6	38	5-7	0	0	0	2	Br
17	0	0	10	29	4-7	0	0	2	1	Br
18	0	0	12	62	6	0	0	3	1	Br
19	0	0	10	37	5-7	0	0	5	1	Br
20	0	0	25	0	-	0	0	11	0	-
21	0	21	4	50	9-100	2	1	51	1	Br
22	0	0	0	43	5-60	0	0	90	40	BrWP
23	0	0	9	16	23-50	0	0	32	0	-
24	0	0	4	0	-	0	0	11	11	BrW
25	0	0	5	0	-	0	0	23	23	BrWP
26	0	0	4	56	11-32	0	0	56	0	-
27	0	0	0	7	21-42	0	0	7	2	BrW
28	0	0	0	3	22-46	0	0	11	13	BrWP
29	10	0	0	11	8	0	0	16	18	BrW
30	54	0	0	0	-	0	0	13	16	BrWP
31	50	0	0	0	-	0	0	11	13	BrWP
32	41	0	0	0	-	0	0	15	18	BrWP
33	104	0	0	0	-	0	0	10	10	BrWP
34	48	0	0	0	-	0	0	4	8	BrWP
35	70	0	0	14	5-7	0	0	0	14	BrWP
36	0	0	0	38	7-8	0	0	0	36	BrWP
37	0	0	14	0	-	0	0	0	0	-
38	0	0	8	0	-	0	0	6	0	-
39	0	0	13	0	-	0	0	13	0	-
40	0	0	28	0	-	0	0	98	0	-
41	0	0	24	11	10	0	0	0	0	-
42	0	0	26	11	10	0	0	0	0	-
43	0	0	2	0	-	0	0	0	0	-
44	0	0	4	2	18	0	0	2	0	-
45	0	0	9	6	14-22	0	0	6	0	-
46	0	0	8	0	-	0	0	6	0	-
47	0	0	11	0	-	0	0	9	0	-
48	0	0	14	3	20-23	0	0	14	2	BrWP
49	0	0	9	6	18-22	0	0	8	0	-
50	0	0	11	4	25-35	0	0	9	0	-

Abbreviations

Colour of internal cavities - Br=brown, Bl=blue, W=white, P=pink

FIGURE 2 - Diagram grouping objects 1 - 50 completed in same month and indicating month completed
(Objects in construction order)

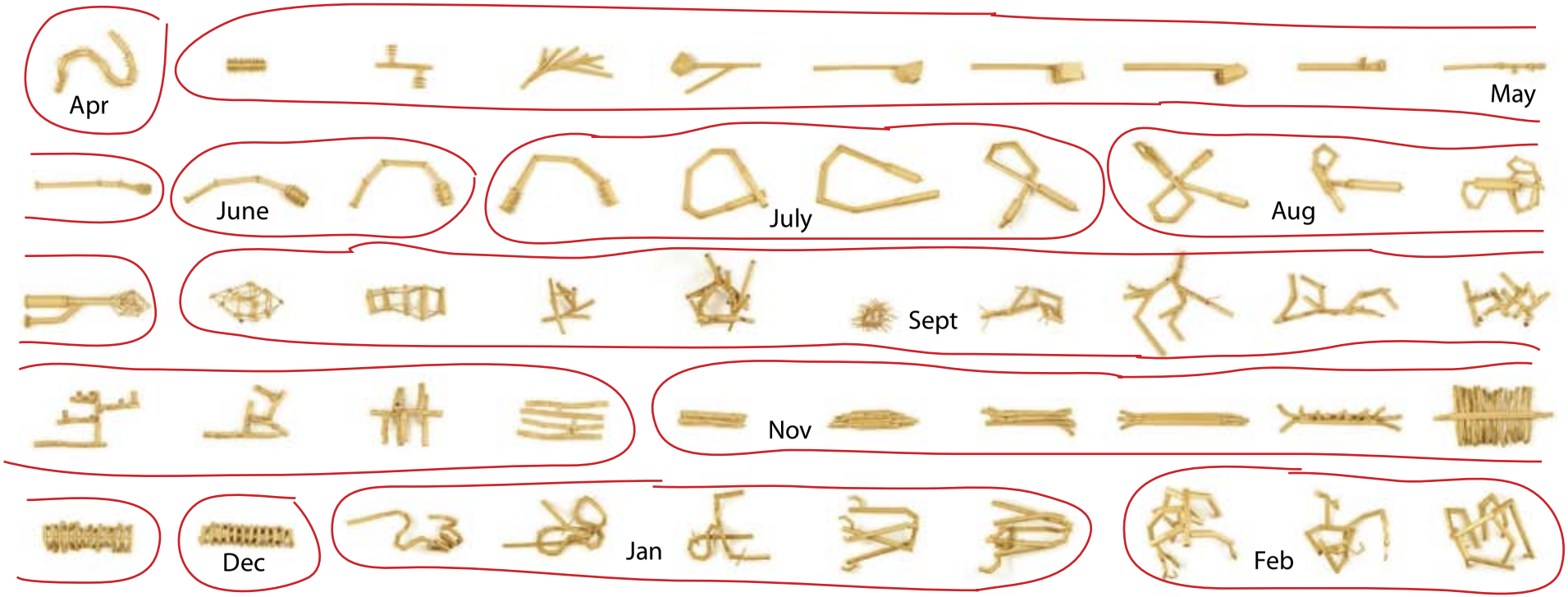


FIGURE 3 - Diagram grouping objects 1 - 50 completed on the same day and indicating DLOC (days since last object completed) numerically. (Objects in construction order)

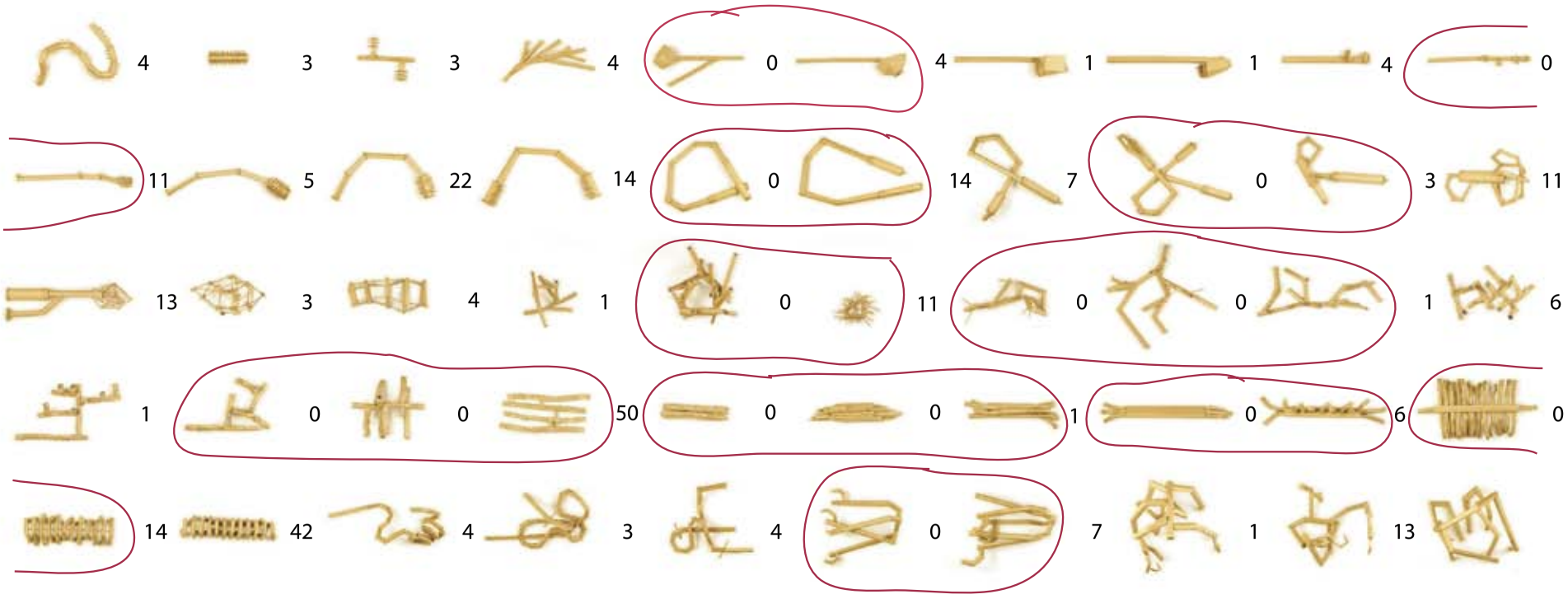


FIGURE 4 - Diagram indicating weight in grams of objects 1 - 50
(Objects in construction order)

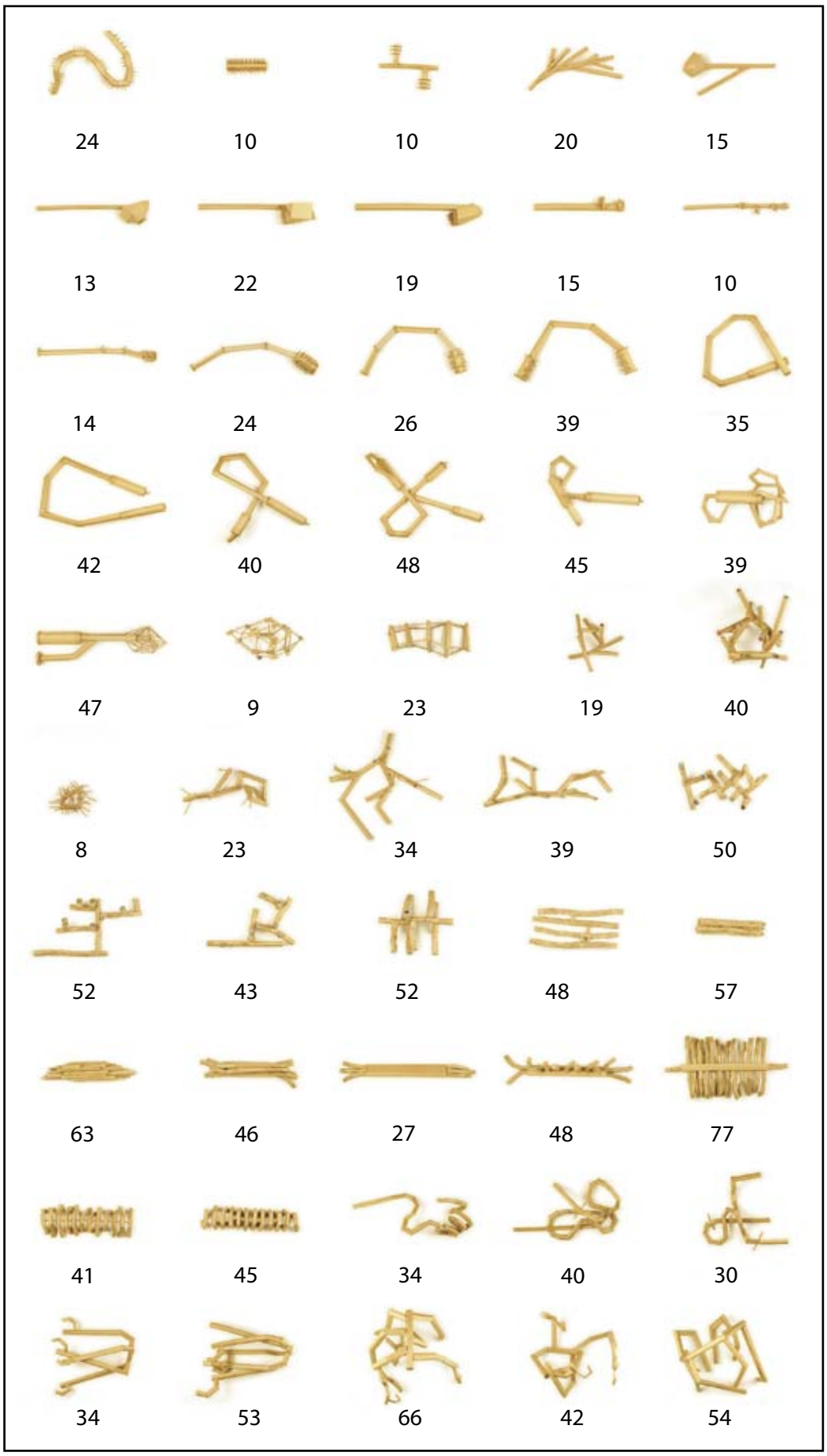


FIGURE 5 - Diagram indicating the day of the week objects 1 - 50 completed (Objects in construction order)

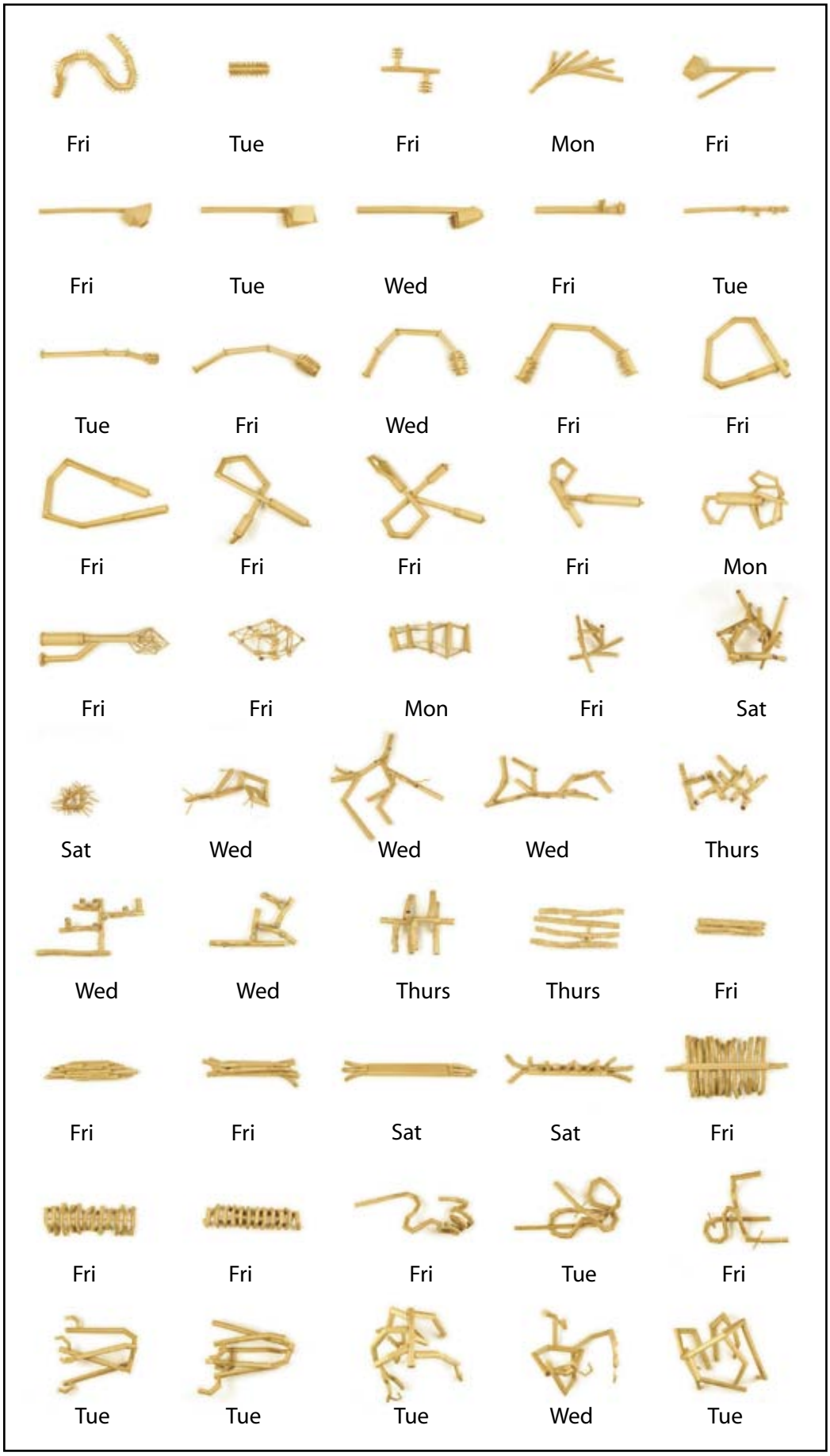


FIGURE 6 - Diagram indicating number of visible parts of objects 1 - 50
(Objects in construction order)

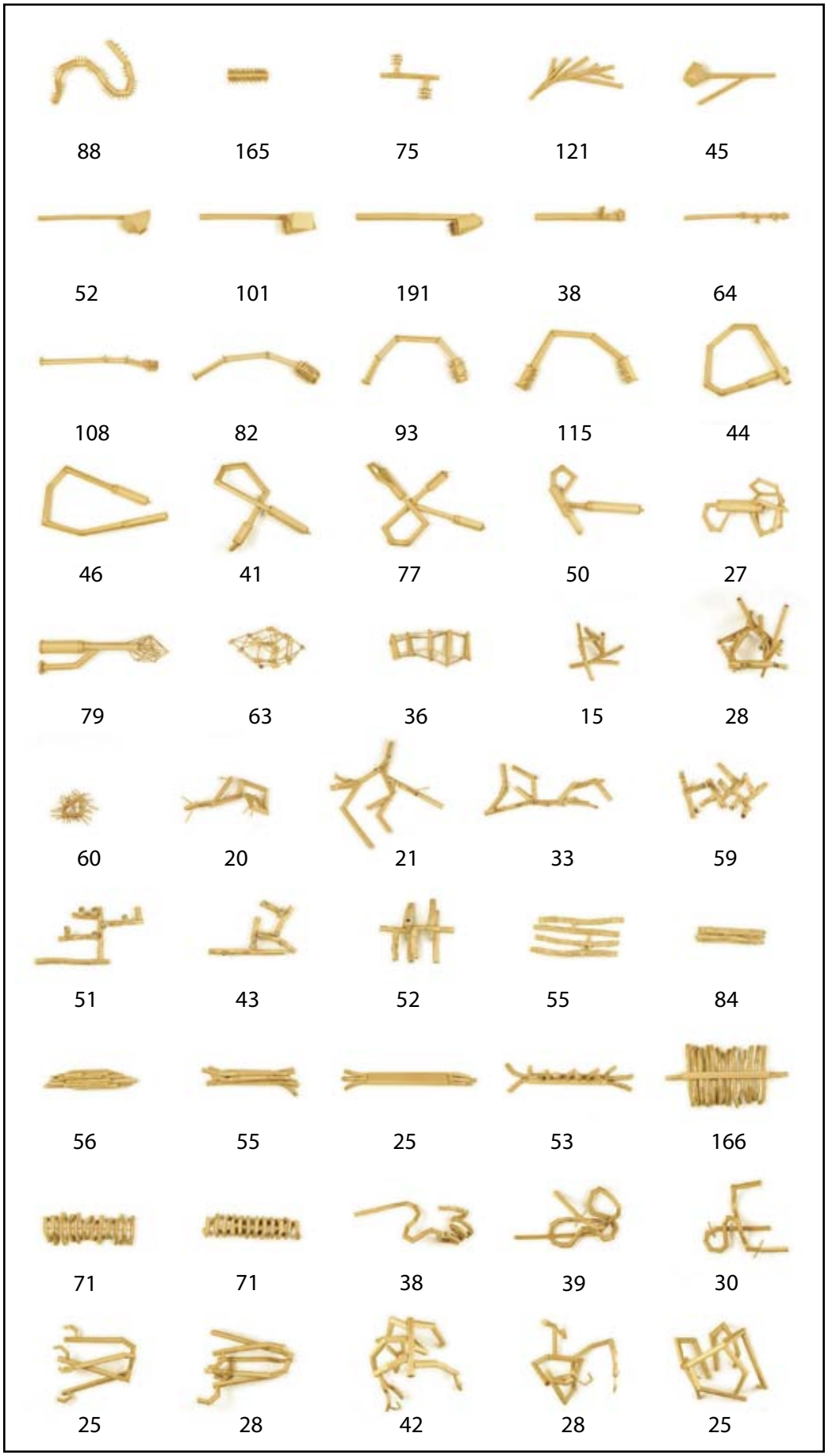
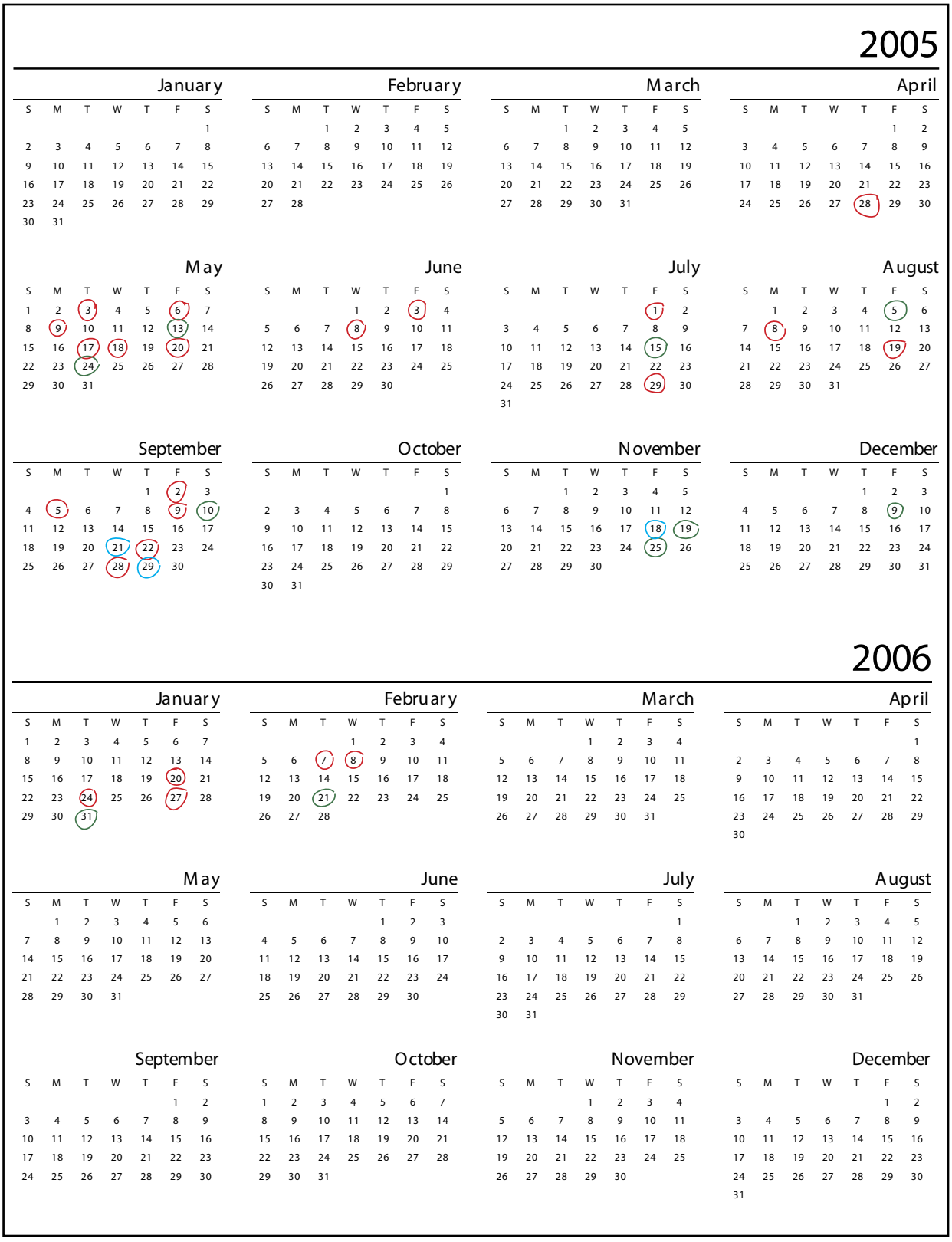
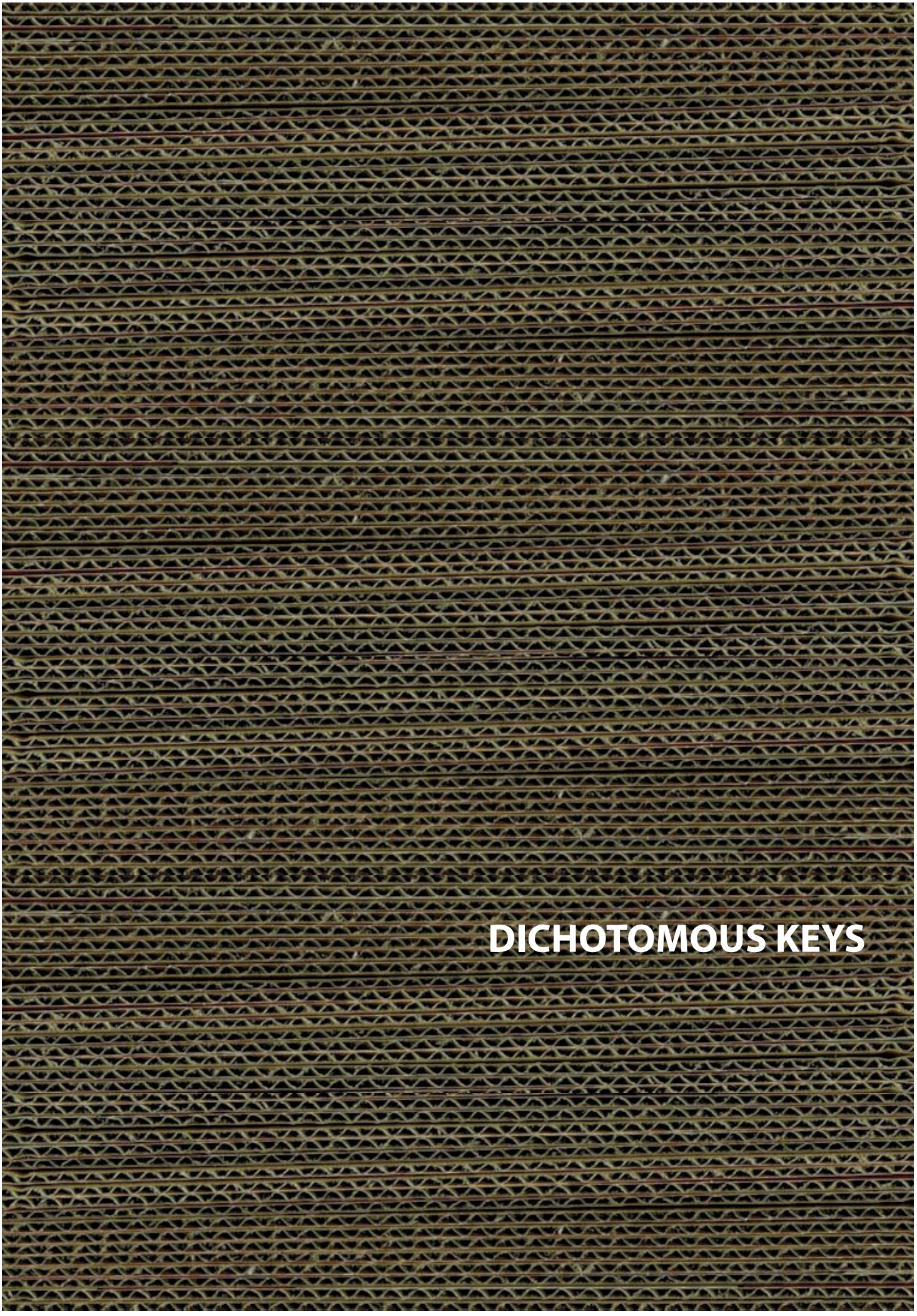


FIGURE 7 - 2005 and 2006 calendars indicating completion days for research series objects



KEY

red circle = one object completed
blue circle = two objects completed
green circle = three objects completed



DICHOTOMOUS KEYS

Dichotomous keys are a step by step written device for scientific identification widely used in biology and other fields. These keys consist of a series of pairs of mutually exclusive descriptive statements. The observer must decide which of the two statements is correct. The key then directs the observer to the next descriptive couplet until the point of identification is reached. The most prominent features are described early in the key and more individual characteristics are described as the observer works through the couplets. It is an inherently binary system and reliant on the specifics of written descriptive language..

This section contains a number of dichotomous keys that have been constructed using the collected data. The following keys are included:

DICHOTOMOUS KEYS

TEST DICHOTOMOUS KEY A

OBJECTS 1 - 10 (001 - 010)

Format 1

01	granulate nodule without embedded tubules	02
01	granulate nodules with embedded tubules	03
02	less than 50 granulate nodules	**OBJECT 005**
02	more than 50 granulate nodules	**OBJECT 004**
03	segmented	**OBJECT 001**
03	non-segmented	04
04	branching structure	**OBJECT 003**
04	non-branching structure	05
05	symmetrical	**OBJECT 002**
05	asymmetrical	06
06	brown internal cavities	07
06	non-brown internal cavities	**OBJECT 009**
07	0 – 2 DLOC	08
07	> 3 DLOC	09
08	completion day = Wednesday	**OBJECT 008**
08	completion day = Friday	**OBJECT 006**
09	length < 300mm	**OBJECT 010**
09	length > 300mm	**OBJECT 007**

TEST DICHOTOMOUS KEY A

OBJECTS 1 - 10 (001 - 010)

Format 2

1	a. granulate nodule without embedded tubules	go to 2
	b. granulate nodules with embedded tubules	go to 3
2	a. less than 50 granulate nodules	**OBJECT 005**
	b. more than 50 granulate nodules	**OBJECT 004**
3	a. segmented	**OBJECT 001**
	b. non-segmented	go to 4
4	a. branching structure	**OBJECT 003**
	b. non-branching structure	go to 5
5	a. symmetrical	**OBJECT 002**
	b. asymmetrical	go to 6
6	a. brown internal cavities	go to 7
	b. non-brown internal cavities	**OBJECT 009**
7	a. 0 – 2 DLOC	go to 8
	b. > 3 DLOC	go to 9
8	a. completion day = Wednesday	**OBJECT 008**
	b.completion day = Friday	**OBJECT 006**
9	a. length < 300mm	**OBJECT 010**
	b. length > 300mm	**OBJECT 007**

TEST DICHOTOMOUS KEY A

OBJECTS 1 - 10 (001 - 010)

Format 3

STEP	FROM	CHARACTERS	OBJECT
1a		Granulate nodules without embedded tubules … go to 2	
1b		Granulate nodules with embedded tubules … go to 3	
2a	1a	Less than 50 granulate nodules	 OBJECT 005
2b	1a	More than 50 granulate nodules	 OBJECT 004
3a	1b	Segmented	 OBJECT 001
3b	1b	Non-segmented … go to 4	
4a	3b	Branching structure	 OBJECT 003
4b	3b	Non-branching structure … go to 5	

TEST DICHOTOMOUS KEY A Format 3 continued

5a	4b	Symmetrical	  OBJECT 002
5b	4b	Asymmetrical … go to 6	
6a	5b	Brown internal cavities … go to 7	
6b	5b	Not brown internal cavities	  OBJECT 009
7a	6a	0 – 2 days since last object completed (DLOC) … go to 8	
7b	6a	More than 3 days since last object completed (DLOC) … go to 9	
8a	7a	Completion day - Wednesday	  OBJECT 008
8b	7a	Completion day Friday	  OBJECT 006
9a	7b	Length less than 300mm	  OBJECT 010
9b	7b	Length more than 300mm	  OBJECT 007

TEST DICHOTOMOUS KEY B
OBJECTS 1 - 10 (001 - 010

Format 1

01	Total number of parts < 100	02
01	Total number of parts > 100	03
02	Total number of connections between parts > number of parts	04
02	Total number of connections between parts < number of parts	05
03	Total number of granulate nodules < 50	06
03	Total number of granulate nodules > 50	**OBJECT 007**
04	branching structure	**OBJECT 005**
04	non-branching structure	**OBJECT 006**
05	segmented	**OBJECT 001**
05	non segmented	07
06	0 – 2 DLOC	**OBJECT 008**
06	> 3 DLOC	08
07	brown internal cavities	09
07	not brown internal cavities	**OBJECT 009**
08	completion day = Tuesday	**OBJECT 002**
08	completion day = Monday	**OBJECT 004**
09	length < 200mm	**OBJECT 003**
09	length > 200mm	**OBJECT 010**

TEST DICHOTOMOUS KEY B

OBJECTS 1 - 10 (001 - 010)

Format 2

1	a. Total number of parts < 100	go to 2
	b. Total number of parts > 100	go to 3
2	a. Total no. of connections between parts > no. of parts	go to 4
	b. Total no. of connections between parts < no. of parts	go to 5
3	a. Total number of granulate nodules < 50	go to 6
	b. Total number of granulate nodules > 50	**OBJECT 007**
4	a. branching structure	**OBJECT 005**
	b. non-branching structure	**OBJECT 006**
5	a. segmented	**OBJECT 001**
	b. non segmented	go to 7
6	a. 0 – 2 DLOC	**OBJECT 008**
	b. > 3 DLOC	go to 8
7	a. brown internal cavities	go to 9
	b. not brown internal cavities	**OBJECT 009**
8	a. completion day = Tuesday	**OBJECT 002**
	b.completion day = Monday	**OBJECT 004**
9	a. length < 200mm	**OBJECT 003**
	b. length > 200mm	**OBJECT 010**

TEST DICHOTOMOUS KEY B

OBJECTS 1 - 10 (001 - 010)

Format 3

STEP	FROM	CHARACTERS	OBJECT
1a		Total number of parts < 100 … go to 2	
1b		Total number of parts > 100 … go to 3	
2a	1a	Total number of connections between parts > number of parts … go to 4	
2b	1a	Total number of connections between parts < number of parts … go to 5	
3a	1b	Total number of granulate nodules < 50 … go to 6	
3b	1b	Total number of granulate nodules < 50	 OBJECT 007
4a	1a	Branching structure	 OBJECT 005
4b	1a	Non-branching structure	 OBJECT 006
5a	2b	Segmented	 OBJECT 001

TEST DICHOTOMOUS KEY B Format 3 continued

5b	2b	Non segmented … go to 7	
6a	3a	0 – 2 DLOC	 OBJECT 008
6b	3a	3 DLOC … go to 8	
7a	5b	Brown internal cavities … go to 9	
7b	5b	Not brown internal cavities	 OBJECT 009
8a	6b	Completion day - Tuesday	 OBJECT 002
8b	6b	Completion day - Monday	 OBJECT 004
9a	7a	Length less than 200mm	 OBJECT 003
9b	7a	Length more than 200mm	 OBJECT 010

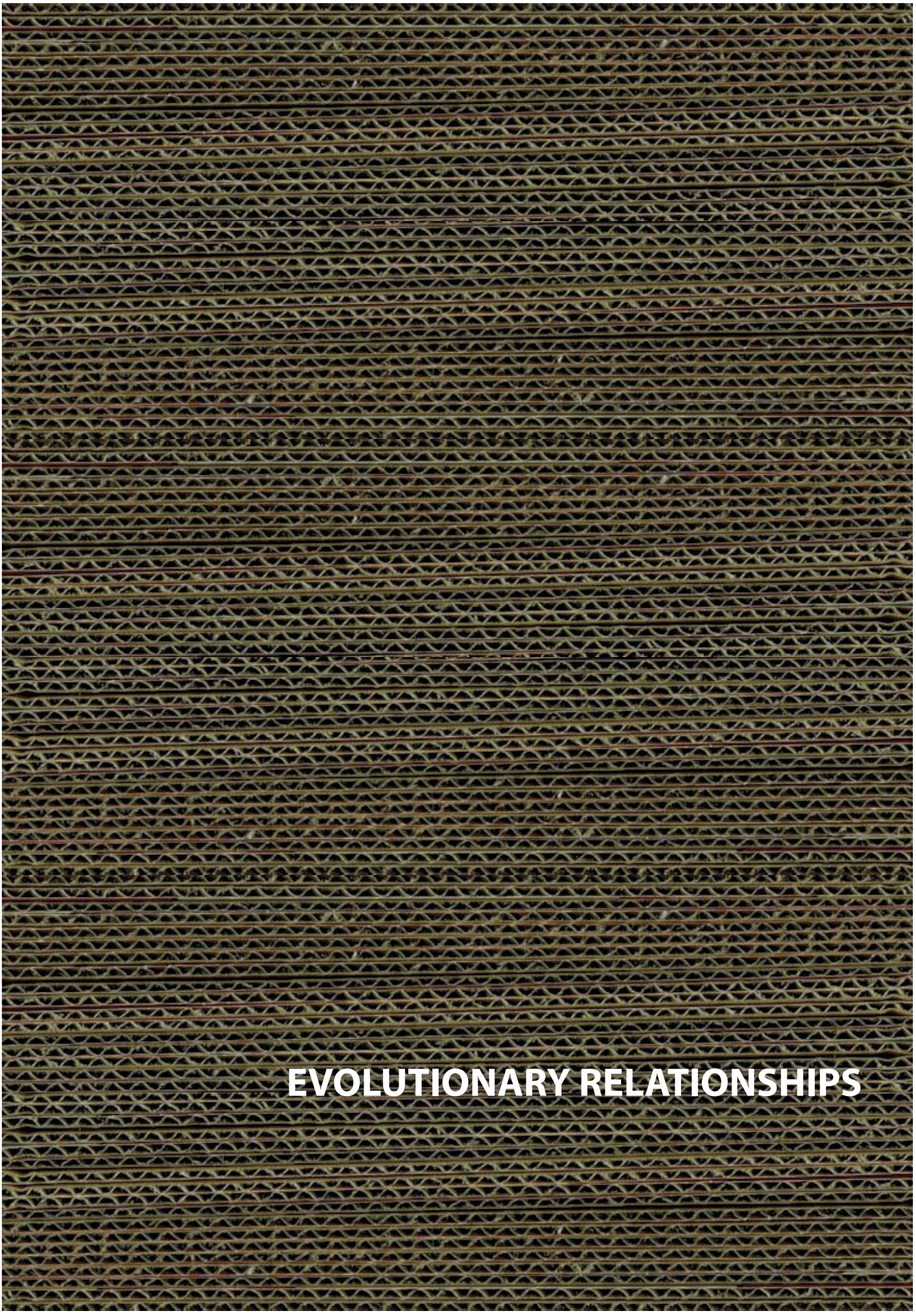
DICHOTOMOUS KEY FOR MISSING LINKS OBJECT RESEARCH SERIES IDENTIFICATION

OBJECTS 1- 50 (001 - 050)

01	Segmented	go to 02
01	Non segmented	go to 03
02	Branching	go to 04
02	Non branching	go to 05
03	Hollow form attached	go to 06
03	Hollow form absent	go to 07
04	Internal cavities visible	go to 08
04	Internal cavities not visible	go to 09
05	Segmental discs present	go to 10
05	Segmental discs absent	go to 11
06	More than 100 parts	OBJECT 006
06	Less than 100 parts	go to 12
07	Unequal numbers of granulate nodules and setae present	OBJECT 010
07	Equal numbers of granulate nodules and setae present	go to 13
08	Internal cavities brown in only	go to 14
08	Internal cavities brown + another colour	go to 15
09	Central linear form present	go to 16
09	Central linear form absent	go to 17
10	More than 2 inter-segmental discs present	OBJECT 014
10	Two or less inter-segmental discs present	go to 18
11	Granulate nodules present	OBJECT 001
11	Granulate nodules absent	go to 19
12	Setae present in ‘V’ shape on hollow form	OBJECT 007
12	Setae not present in ‘V’ shape on hollow form	OBJECT 008
13	More than 5 self supporting orientations evident	OBJECT 002
13	Less than 5 self supporting orientations evident	OBJECT 009
14	More than 2 internal cavities visible	OBJECT 003
14	Less than 2 internal cavities visible	go to 20
15	Internal cavities brown + blue	go to 21
15	Internal cavities not brown + blue	go to 22
16	Tubules perpendicular to central linear form present	go to 23
16	Tubules perpendicular to central linear form absent	go to 24
17	More than 10 branching points present	go to 25
17	Less than 10 branching points present	go to 26

18	Epidermal lamellae present	go to 27
18	Epidermal lamellae absent	OBJECT 013
19	Setae present	go to 28
19	Setae absent	go to 29
20	Granulate nodules present	OBJECT 021
20	Granulate nodules absent	go to 30
21	Structure has multiple branching points	OBJECT 004
21	Structure has single branching point	OBJECT 005
22	Internal cavities brown + white	go to 31
22	Internal cavities brown, white + pink	go to 32
23	Less than 100 tubules present	OBJECT 039
23	More than 100 tubules present	OBJECT 040
24	Central rectilinear form present	OBJECT 038
24	Central rectilinear form absent	OBJECT 020
25	Longest tubule longer than 100mm	OBJECT 023
25	Longest tubule less than 100mm in length	OBJECT 020
26	More than 5 branching points present	OBJECT 044
26	Less than 5 branching points present	go to 33
27	Granulate nodules without embedded setae present	OBJECT 011
27	Granulate nodules without embedded setae absent	OBJECT 012
28	Setae less than 10mm in length present	go to 34
28	Setae less than 10mm in length absent	go to 35
29	Spiral form present	OBJECT 043
29	Spiral form absent	OBJECT 037
30	Length greater than or equal to 300mm	go to 36
30	Length less than 300mm	OBJECT 019
31	Epidermal lamellae present	OBJECT 024
31	Epidermal lamellae absent	go to 37
32	Striations present	go to 38
32	Striations absent	go to 39
33	More than 5 setae present	go to 40
33	Less than 5 setae present	go to 41
34	Less than 10 tubules in total present	go to 42
34	More than 10 tubules in total present	go to 43
35	Length greater than 250mm	OBJECT 042
35	Length less than 250mm	OBJECT 041
36	Setae present in the ends of 2 tubules	OBJECT 018
36	Setae not present in the ends of 2 tubules	OBJECT 017
37	Number of joins less than 30	OBJECT 027
37	Number of joins greater than 30	OBJECT 029

38	More than 100 striations present	OBJECT 033
38	Less than 100 striations present	go to 44
39	Weight less than 30g	OBJECT 022
39	Weight greater than 30g	go to 45
40	More than 5 self supporting orientations evident	OBJECT 049
40	Less than 5 self supporting orientations evident	OBJECT 045
41	Setae present	OBJECT 050
41	Setae absent	go to 46
42	Tubules form closed circular shape	OBJECT 015
42	Tubules form open circular shape	OBJECT 016
43	Smooth surface present	OBJECT 035
43	Smooth surface absent	OBJECT 036
44	All tubules parallel to contact surface	OBJECT 034
44	All tubules not parallel to contact surface	go to 47
45	More than 20 tubules present	go to 48
45	Less than 20 tubules present	OBJECT 028
46	Four branches radiate out from central point	OBJECT 046
46	Five branches radiate out from central point	OBJECT 047
47	Number of joins greater than 50	OBJECT 030
47	Number of joins less than 50	go to 49
48	More than 10 internal cavities visible	OBJECT 025
48	Less than 10 internal cavities visible	OBJECT 048
49	Fifty or more continuous striations present	OBJECT 031
49	Less than 50 continuous striations present	OBJECT 032



EVOLUTIONARY RELATIONSHIPS

Evolutionary relationships were explored in the project using a cladistic approach. This approach employs common ancestry for classification and involves using the collated data to establish whether particular characteristics or character states are ancestral or derived. Ancestral characteristics are those that are shared with another older and related group known as the 'outgroup'. In this case, the 'outgroup' is the test series group of objects. Derived characters are those that are new and are particular to the group in question - the research series group. By analysing the presence of derived characters, possible phylogenetic (developmental) relations and evolutionary histories of the group can be theorised.

This information was used to develop a number of hand drawn evolutionary trees which begin with objects with the least derived characters. One of these trees was used to produce an animation which shows the objects morphing from one to another by using a series of semi-transparent still images. A series of these images is included at the end of this section.

This section includes the following:

EVOLUTIONARY RELATIONSHIPS

FIGURE 8 -Notations on possible evolutionary realtionships between objects 1 - 50
(Objects in construction order)

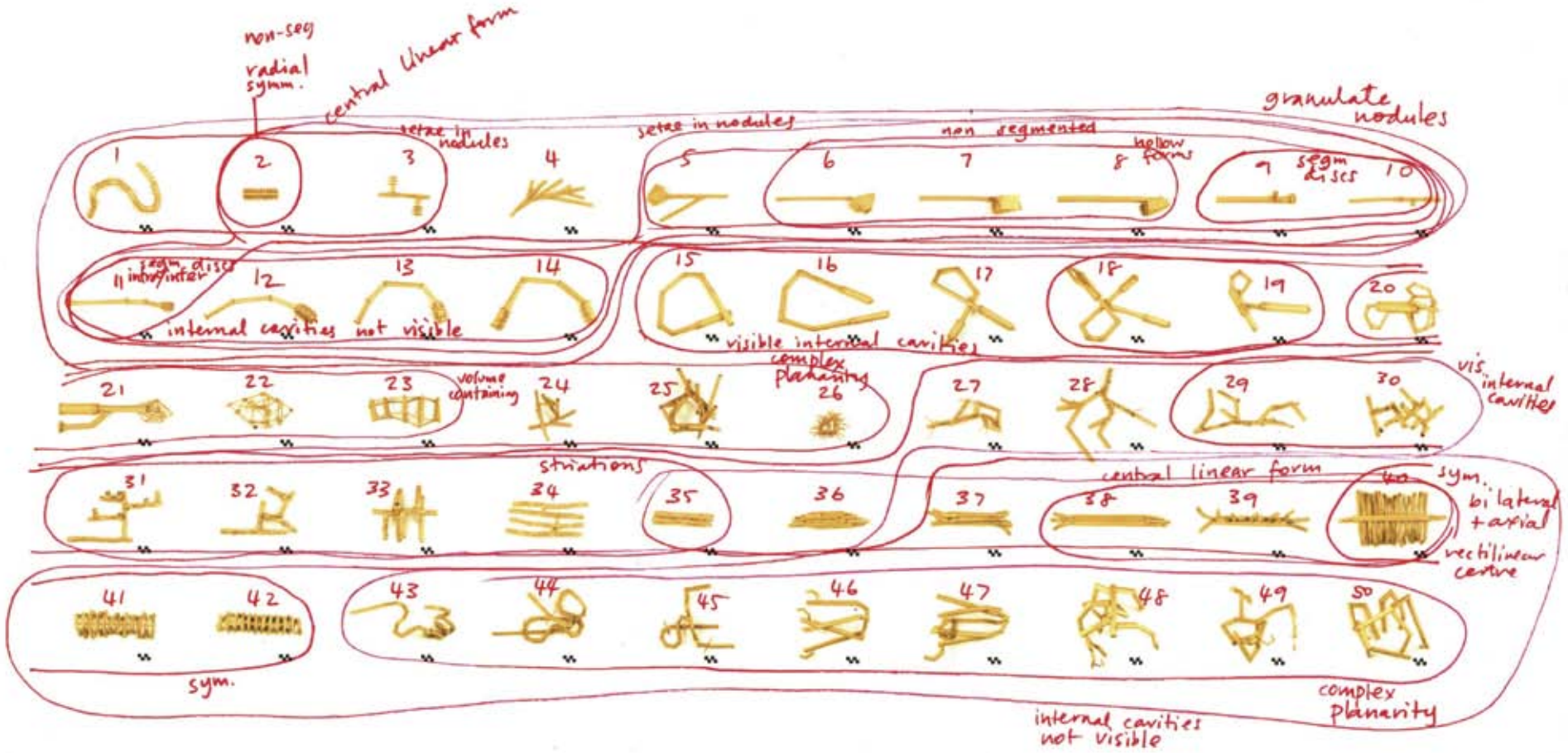


TABLE 5 - Characters and character states of objects 1 - 50 indicating ancestral or derived status.

CHARACTER	CHARACTER STATE	ANCESTRAL / DERIVED
Internal cavities	visible	ancestral
	Non-visible	ancestral
Setae	no granulate nodule	ancestral
	in granulate nodule	derived
General form	Tubular	ancestral
	Flat rectilinear	ancestral
Lamellae	Present	ancestral
	Absent	ancestral
Segmentation	Segmented	ancestral
	Non segmented	ancestral
Symmetry	Bilateral symmetry	ancestral
	Radial symmetry	derived
	Assymmetry	derived
Planarity	simple	ancestral
	complex	derived
Branching	branching	ancestral
	Non branching	ancestral
Surface	Smooth	ancestral
	Granulate nodule	derived
	Striations	derived
Segmental discs	Inter	derived
	intra	derived
	Non-segmental	derived
	absent	ancestral
No. of parts	Equal to no. of connections	ancestral
	< no. of connections	derived
Hollow forms	present	derived
	absent	ancestral

Notes

- Ancestral forms are original or plesiomorphic. These features are shared more widely than in the research series. These are primitive for the group in question and cannot provide evidence for the group. They are shared with the OUTGROUP – the test series

- Derived forms are changed/new or apomorphic. They are an evolutionary novelty for the group and are evidence for the existence of the group. These shared attributes are taken to indicate a shared evolutionary history. A novel evolutionary trait that is unique to a particular species and all its descendants can be used as a defining character for a species or group in phylogenetic terms.

TABLE 6 - Presence of selected character states in objects 1-50

OBJECT	segmented	branching	setae in nodules	nodules without setae	setae without nodules	symm etrical	simple planarity	visible internal cavities	hollow forms	central linear form	
1	Y	N	Y	N	N	N	Y	Y	N	N	1
2	N	N	Y	N	N	Y	Y	Y	N	N	2
3	N	Y	Y	N	N	N	Y	Y	N	N	3
4	N	Y	N	Y	N	N	N	Y	N	N	4
5	N	Y	N	Y	N	N	Y	Y	Y	Y	5
6	N	N	Y	N	N	N	Y	Y	Y	Y	6
7	N	N	Y	N	N	N	Y	Y	Y	Y	7
8	N	N	Y	N	N	N	Y	Y	Y	Y	8
9	N	N	Y	N	N	N	Y	Y	N	Y	9
10	N	N	Y	Y	N	N	Y	Y	N	Y	10
11	Y	N	Y	Y	N	N	Y	N	N	Y	11
12	Y	N	Y	N	N	N	Y	N	N	Y	12
13	Y	N	Y	N	N	N	Y	N	N	Y	13
14	Y	N	Y	N	N	N	Y	Y	N	Y	14
15	Y	N	N	N	Y	N	Y	Y	N	Y	15
16	Y	N	N	N	Y	N	Y	Y	N	Y	16
17	Y	Y	N	N	Y	N	N	Y	N	N	17
18	Y	Y	N	N	Y	N	N	Y	N	N	18
19	Y	Y	N	N	Y	N	N	Y	N	N	19
20	Y	Y	N	N	N	N	N	N	N	N	20
21	Y	Y	Y	N	N	N	Y	Y	N open	Y	21
22	Y	Y	N	N	Y	N	N	Y	N open	N	22
23	Y	Y	N	N	Y	N	N	N	N open	N	23
24	Y	Y	N	N	N	N	N	Y	N	N	24
25	Y	Y	N	N	N	N	N	Y	N	N	25
26	Y	Y	N	N	Y	N	N	N	N	N	26
27	Y	Y	N	N	Y	N	N	Y	N	N	27
28	Y	Y	N	N	Y	N	N	Y	N	N	28
29	Y	Y	N	N	Y	N	Y	Y	N	N	29
30	Y	Y	N	N	N	N	N	Y	N	N	30
31	Y	Y	N	N	N	N	N	Y	N	N	31
32	Y	Y	N	N	N	N	N	Y	N	N	32
33	Y	Y	N	N	N	N	N	Y	N	N	33
34	Y	Y	N	N	N	N	Y	Y	N	N	34
35	Y	N	Y	N	Y	Y	Y	Y	N	N	35
36	N	N	N	N	Y	N	Y	Y	N	N	36
37	Y	N	N	N	N	N	Y	N	N	N	37
38	Y	N	N	N	N	N	Y	N	N	N	38
39	Y	Y	N	N	N	N	N	N	N	N	39
40	Y	Y	N	N	N	Y	Y	N	N	N	40
41	Y	Y	N	N	Y	Y	N	N	N	N	41
42	Y	Y	N	N	Y	Y	Y	N	N	N	42
43	Y	N	N	N	N	N	N	N	N	N	43
44	Y	N	N	N	Y	N	N	N	N	N	44
45	Y	Y	N	N	Y	N	N	N	N	N	45
46	Y	Y	N	N	N	N	N	N	N	N	46
47	Y	Y	N	N	N	N	N	N	N	N	47
48	Y	Y	N	N	Y	N	N	N	N	N	48
49	Y	Y	N	N	Y	N	N	N	N	N	49
50	Y	Y	N	N	Y	N	N	Y	N	N	50
	segmented	branching	setae in nodules	nodules without setae	setae without nodules	symm etrical	simple planarity	visible internal cavities	hollow forms	linear body	

Key - Y indicates that character is present, N indicates hat character is absent

TABLE 7 - Presence and enumeration of selected derived character states in objects 1-50

No.	segments	setae in nodules	Radial symm	Asymm.	Compl planar	Gran. nodules	hollow forms	Stria tions	Seg-mental discs	Totals
1	1	1	0	1	0	0	0	0	0	3
2	0	1	1	0	0	0	0	0	0	2
3	1	1	0	1	0	0	0	0	0	3
4	1	0	0	1	0	1	0	0	0	3
5	1	0	0	1	0	1	1	0	0	4
6	0	1	0	1	0	0	1	0	0	3
7	0	1	0	1	0	0	1	0	0	3
8	0	1	0	1	0	0	1	0	0	3
9	0	1	0	1	0	0	0	0	1	3
10	0	1	0	1	0	1	0	0	1	4
11	1	1	0	1	0	1	0	0	1	5
12	1	1	0	1	0	0	0	0	1	4
13	1	1	0	1	0	0	0	0	1	4
14	1	1	0	1	0	0	0	0	1	4
15	1	0	0	1	0	0	0	0	0	2
16	1	0	0	1	0	0	0	0	0	2
17	1	0	0	1	0	0	0	0	0	2
18	1	0	0	1	1	0	0	0	0	3
19	1	0	0	1	1	0	0	0	0	3
20	1	0	0	1	1	0	0	0	0	3
21	1	1	0	1	1	0	0	0	0	4
22	1	0	0	1	1	0	0	0	0	3
23	1	0	0	1	1	0	0	0	0	3
24	1	0	0	1	1	0	0	0	0	3
25	1	0	0	1	1	0	0	0	0	3
26	1	0	0	1	0	0	0	0	0	3
27	1	0	0	1	0	0	0	0	0	3
28	1	0	0	1	0	0	0	0	0	3
29	1	0	0	1	0	0	0	1	0	4
30	1	0	0	1	0	0	0	1	0	4
31	1	0	0	1	0	0	0	1	0	4
32	1	0	0	1	0	0	0	1	0	4
33	1	0	0	1	0	0	0	1	0	4
34	1	0	0	1	0	0	0	1	0	3
35	1	0	0	0	0	0	0	1	0	3
36	1	0	0	1	0	0	0	0	0	2
37	1	0	0	1	0	0	0	0	0	2
38	1	0	0	1	0	0	0	0	0	2
39	1	0	0	1	0	0	0	0	0	3
40	1	0	0	0	0	0	0	0	0	2
41	1	0	0	0	0	0	0	0	0	2
42	1	0	0	0	0	0	0	0	0	2
43	1	0	0	1	1	0	0	0	0	3
44	1	0	0	1	1	0	0	0	0	3
45	1	0	0	1	1	0	0	0	0	3
46	1	0	0	1	1	0	0	0	0	3
47	1	0	0	1	1	0	0	0	0	3
48	1	0	0	1	1	0	0	0	0	3
49	1	0	0	1	1	0	0	0	0	3
50	1	0	0	1	1	0	0	0	0	3
Tot	45	14	1	45	17	4	4	7	6	

Key - 1 indicates character is present, 0 indicates character is absent

TABLE 8 - Numerical ranking of objects1-50 in relation to derived character states present

Number of states	Object	Character states
2	2	Setae in nodules, radial symmetry
	3	Setae in nodules, asymmetrical
	4	Asymmetrical, granulate nodules
	15	Segmented, asymmetrical
	16	Segmented, asymmetrical
	17	Segmented, asymmetrical
	36	Segmented, asymmetrical
	37	Segmented, asymmetrical
	38	Segmented, asymmetrical
	40	Segmented, complex planarity
	41	Segmented, complex planarity
	42	Segmented, complex planarity
3	1	Segmented, setae in nodules, asymmetrical
	5	Asymmetrical, granulate nodules, hollow form
	6	Setae in nodules, asymmetrical, hollow form
	7	Setae in nodules, asymmetrical, hollow form
	8	Setae in nodules, asymmetrical, hollow form
	9	Setae in nodules, asymmetrical, segmental discs
	18	Segmented, asymmetrical, complex planarity
	19	Segmented, asymmetrical, complex planarity
	20	Segmented, asymmetrical, complex planarity
	22	Segmented, asymmetrical, complex planarity
	23	Segmented, asymmetrical, complex planarity
	24	Segmented, asymmetrical, complex planarity
	25	Segmented, asymmetrical, complex planarity
	26	Segmented, asymmetrical, complex planarity
	27	Segmented, asymmetrical, complex planarity
	28	Segmented, asymmetrical, complex planarity
	34	Segmented, asymmetrical, striated
	35	Segmented, setae in nodules, striated
	39	Segmented, asymmetrical, complex planarity
	43	Segmented, asymmetrical, complex planarity
	44	Segmented, asymmetrical, complex planarity
	45	Segmented, asymmetrical, complex planarity
	46	Segmented, asymmetrical, complex planarity
	47	Segmented, asymmetrical, complex planarity
	48	Segmented, asymmetrical, complex planarity
	49	Segmented, asymmetrical, complex planarity
	50	Segmented, asymmetrical, complex planarity
4	10	Setae in nodules, asymmetrical, granulate nodules, segmental discs
	12	Segmented, setae in nodules, asymmetrical, segmental discs
	13	Segmented, setae in nodules, asymmetrical, segmental discs
	14	Segmented, setae in nodules, asymmetrical, segmental discs
	21	Segmented, setae in nodules, asymmetrical, complex planarity
	29	Segmented, asymmetrical, complex planarity, striated
	30	Segmented, asymmetrical, complex planarity, striated
	31	Segmented, asymmetrical, complex planarity, striated
	32	Segmented, asymmetrical, complex planarity, striated
	33	Segmented, asymmetrical, complex planarity, striated
5	11	Segmented, setae in nodules, asymmetrical, granulate nodules, segmental discs

FIGURES 9 - 12 - Process of theorising evolutionary relationships between research series objects using photographic images and data from Table 8

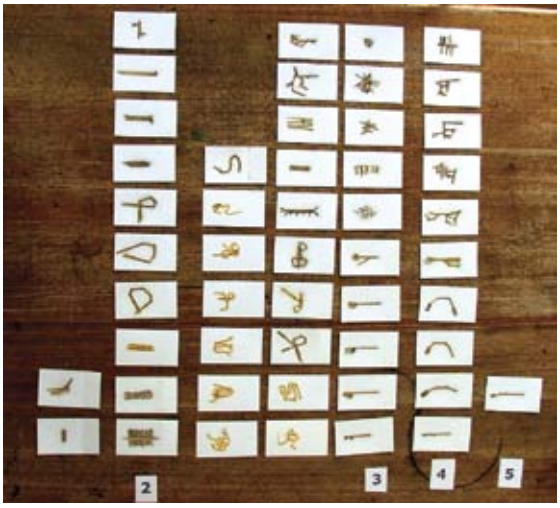


Figure 9
The numbers refer to the number of derived character states that are present in each object. Out of a total of nine states, twelve objects have two, 27 objects have three, ten objects have four and one object has five. If we assume that the object with the greatest number of derived character states is the most evolved, then object 11 is the most evolved.

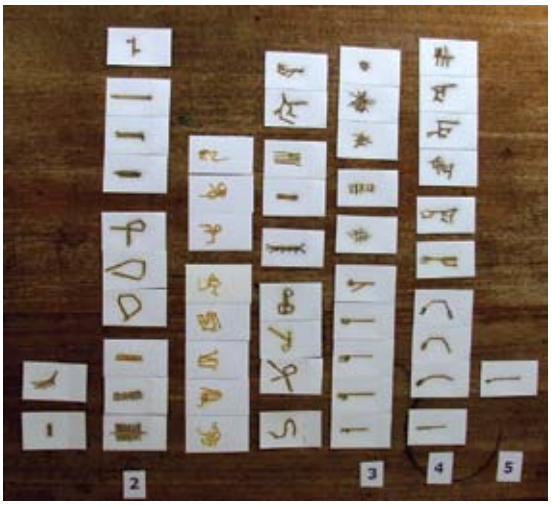


Figure 10
Using the same format as Figure 9, objects with similar morphology are grouped together within the character state grouping. These similarities are also evident in the derived character states data in Table 8.

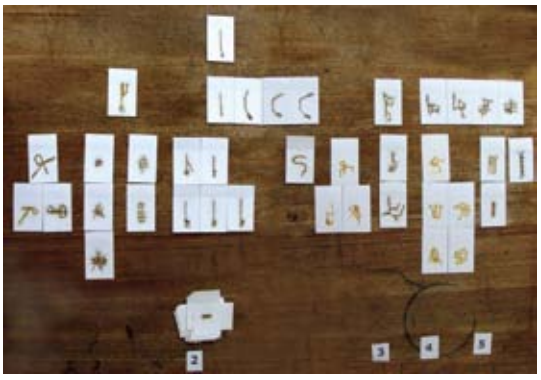


Figure 11
Using a slightly different format, objects are grouped using a combination of character states and visible morphology. Tree is beginning to form..

Figure 12
Evolutionary tree is becoming more apparent as associations between different objects become more apparent.

FIGURE 13 - Hand drawn cladogram theorising evolutionary relationships between research series objects

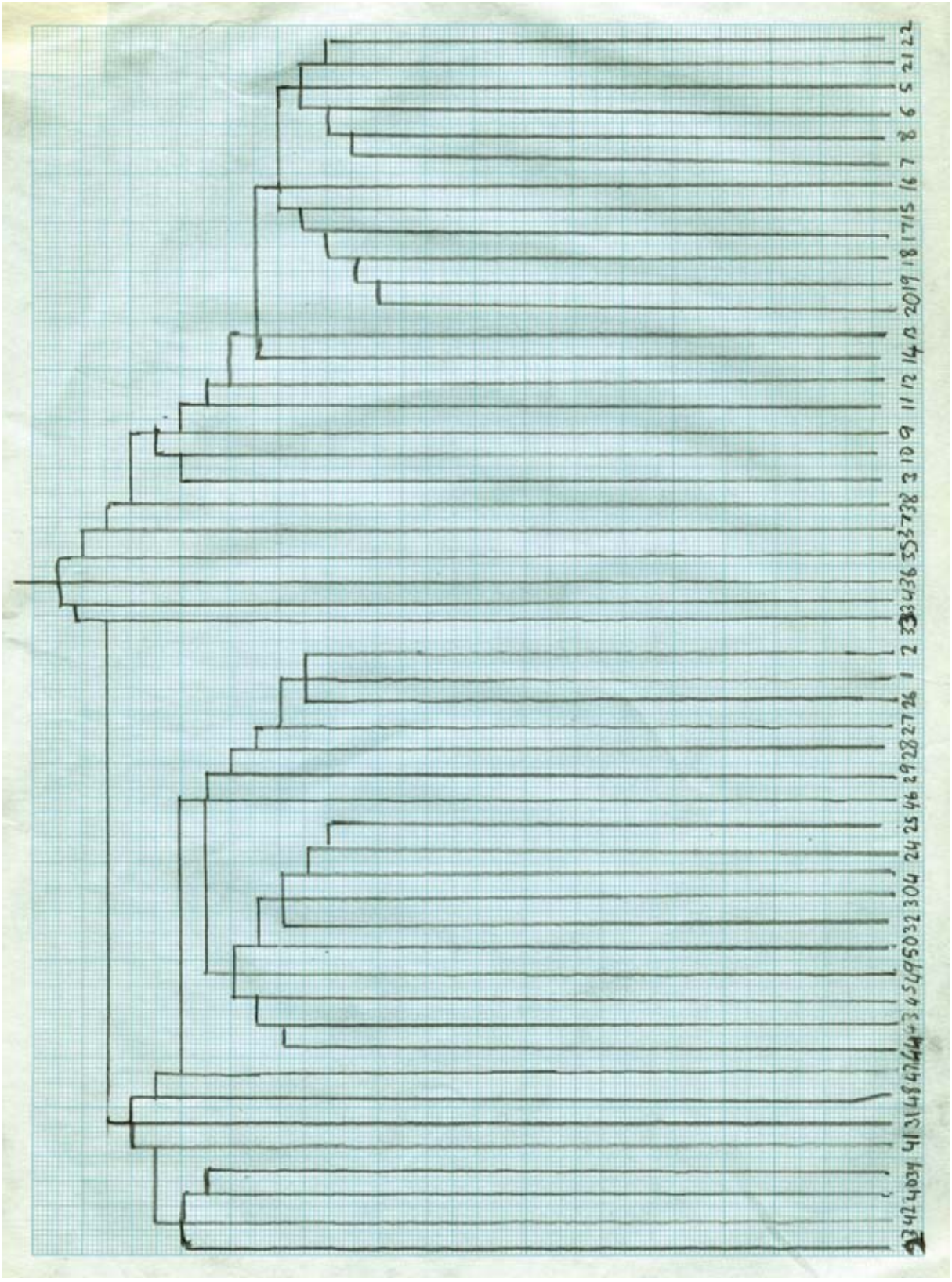


FIGURE 14 - Hand drawn evolutionary tree illustrating possible relationships between research series objects beginning with object 3

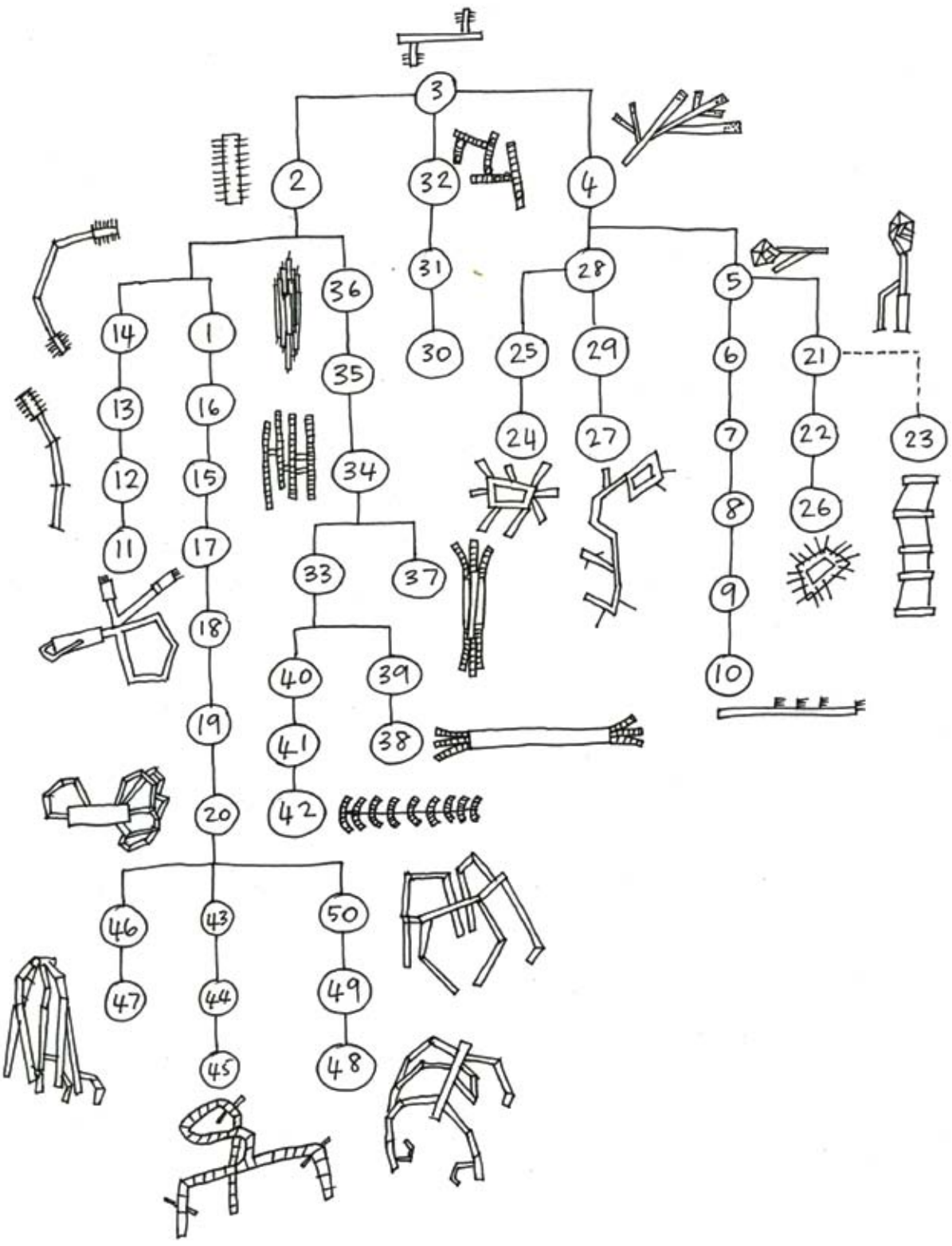
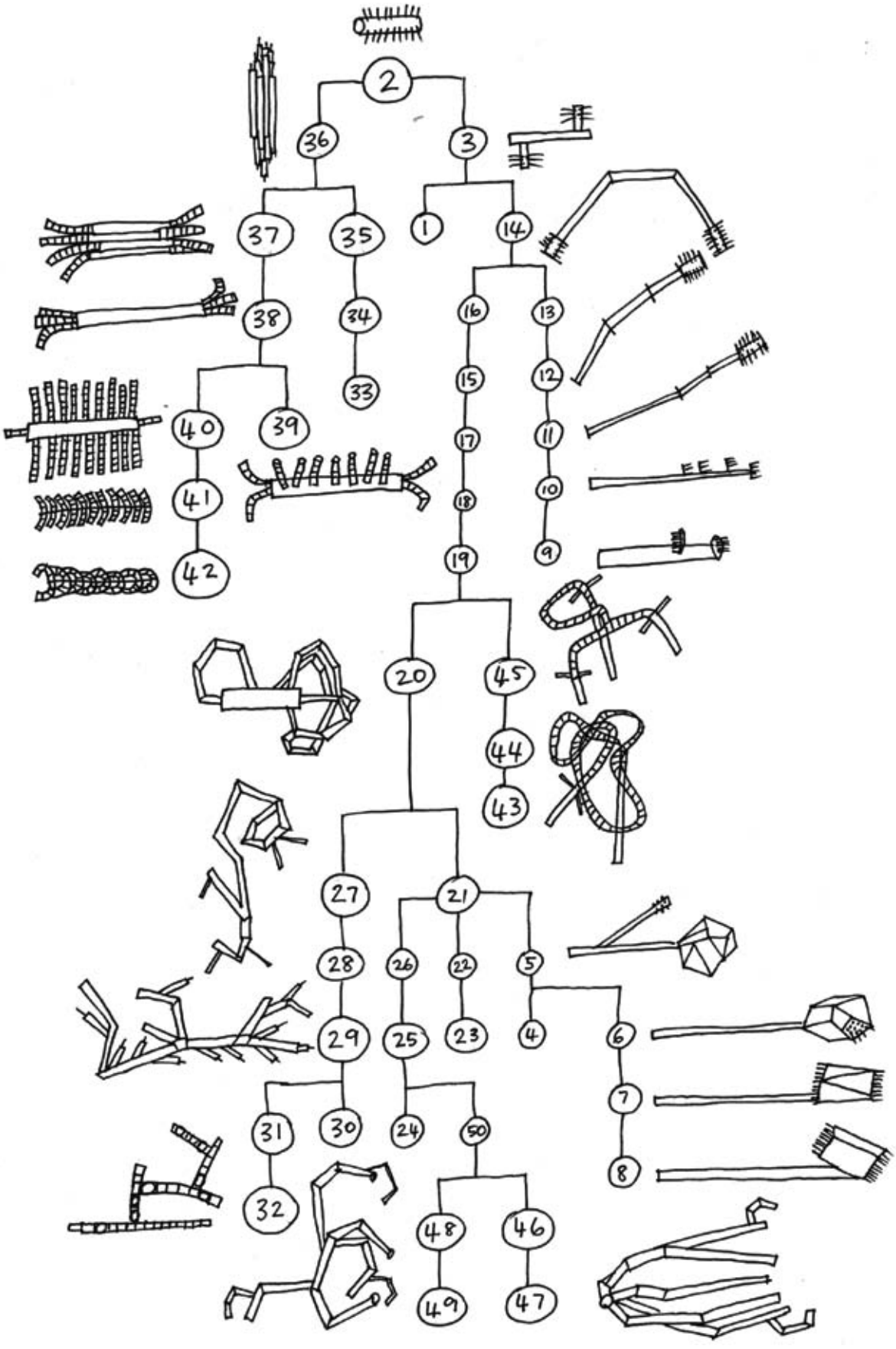
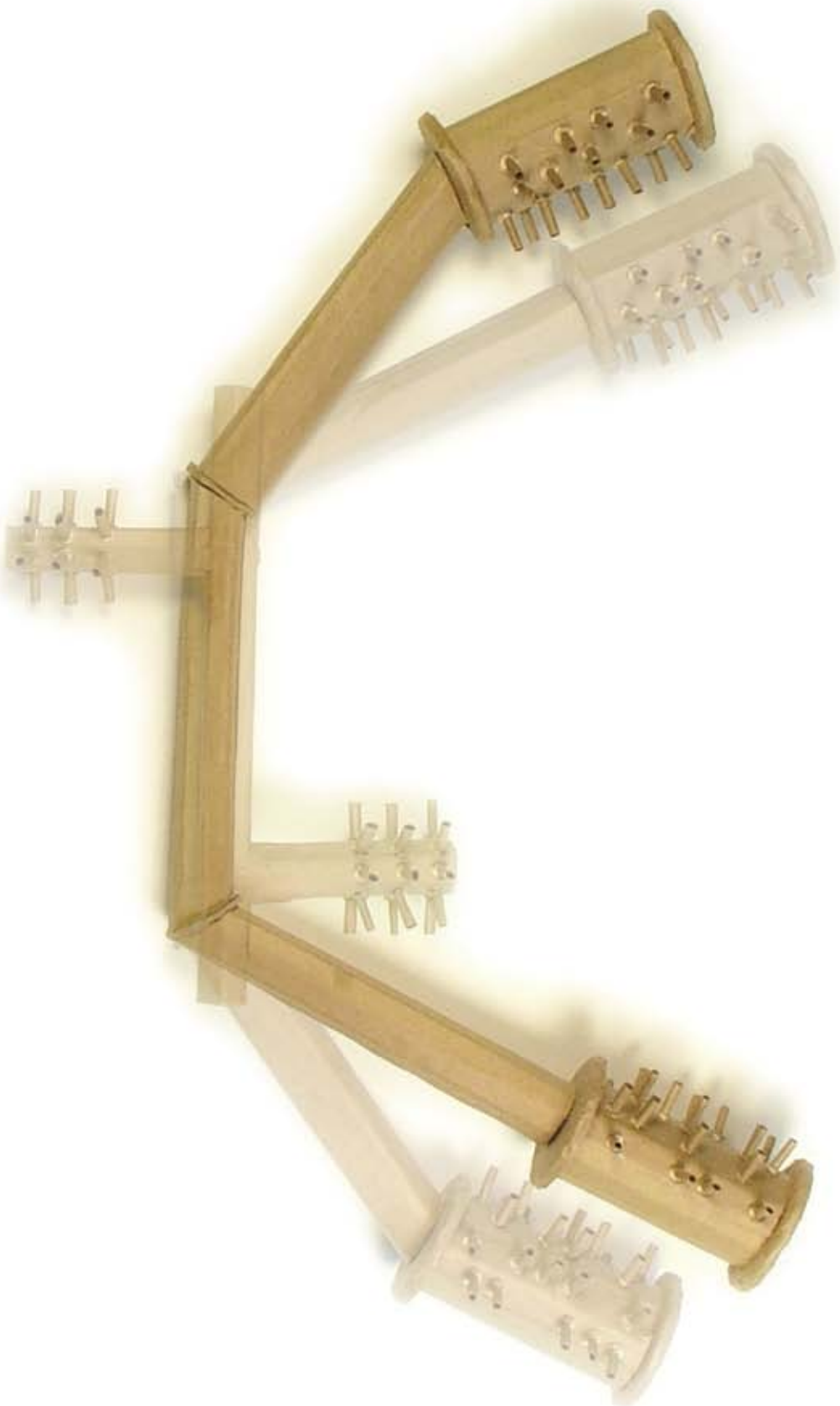


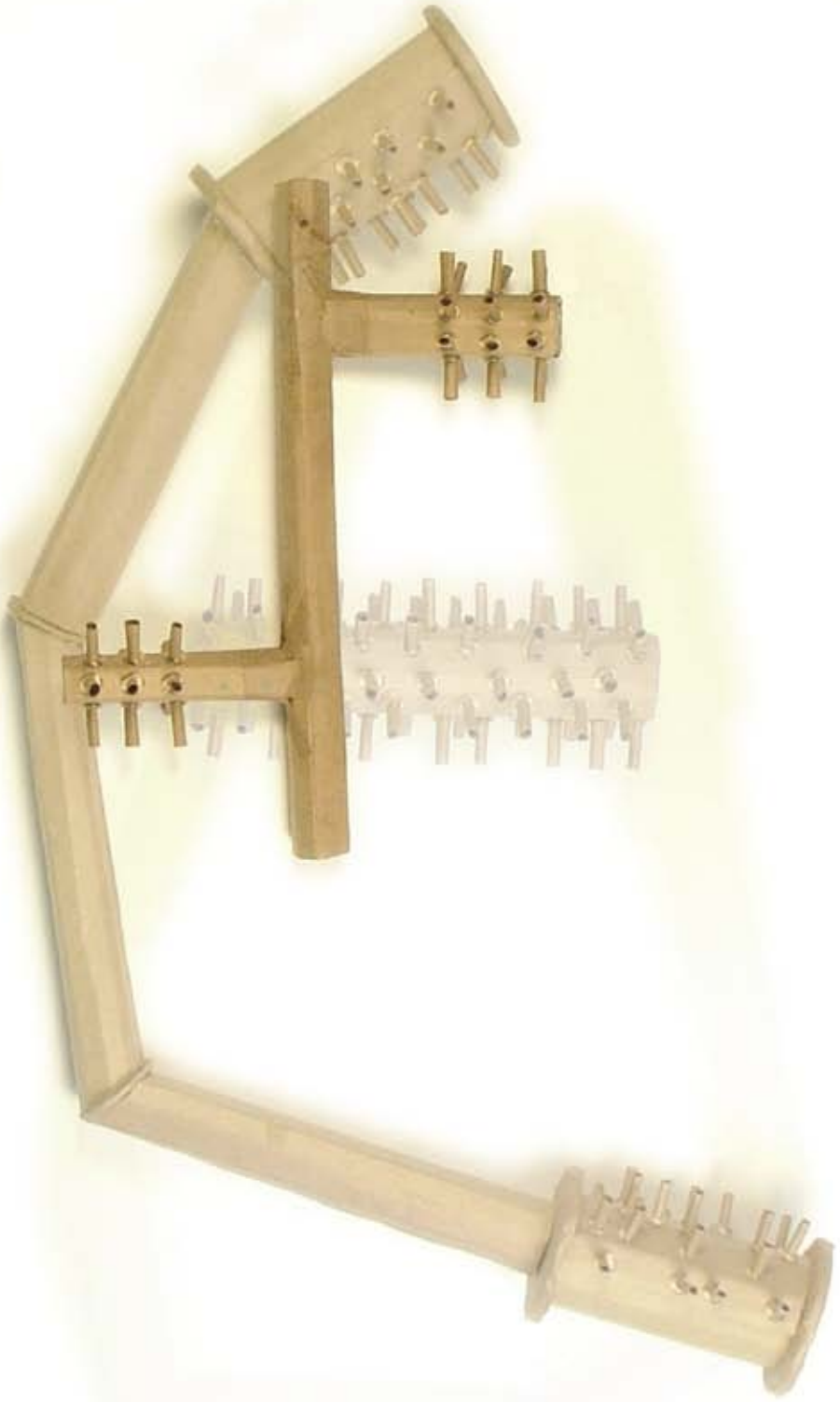
FIGURE 15 - Hand drawn evolutionary tree illustrating possible relationships between research series objects beginning with object 2

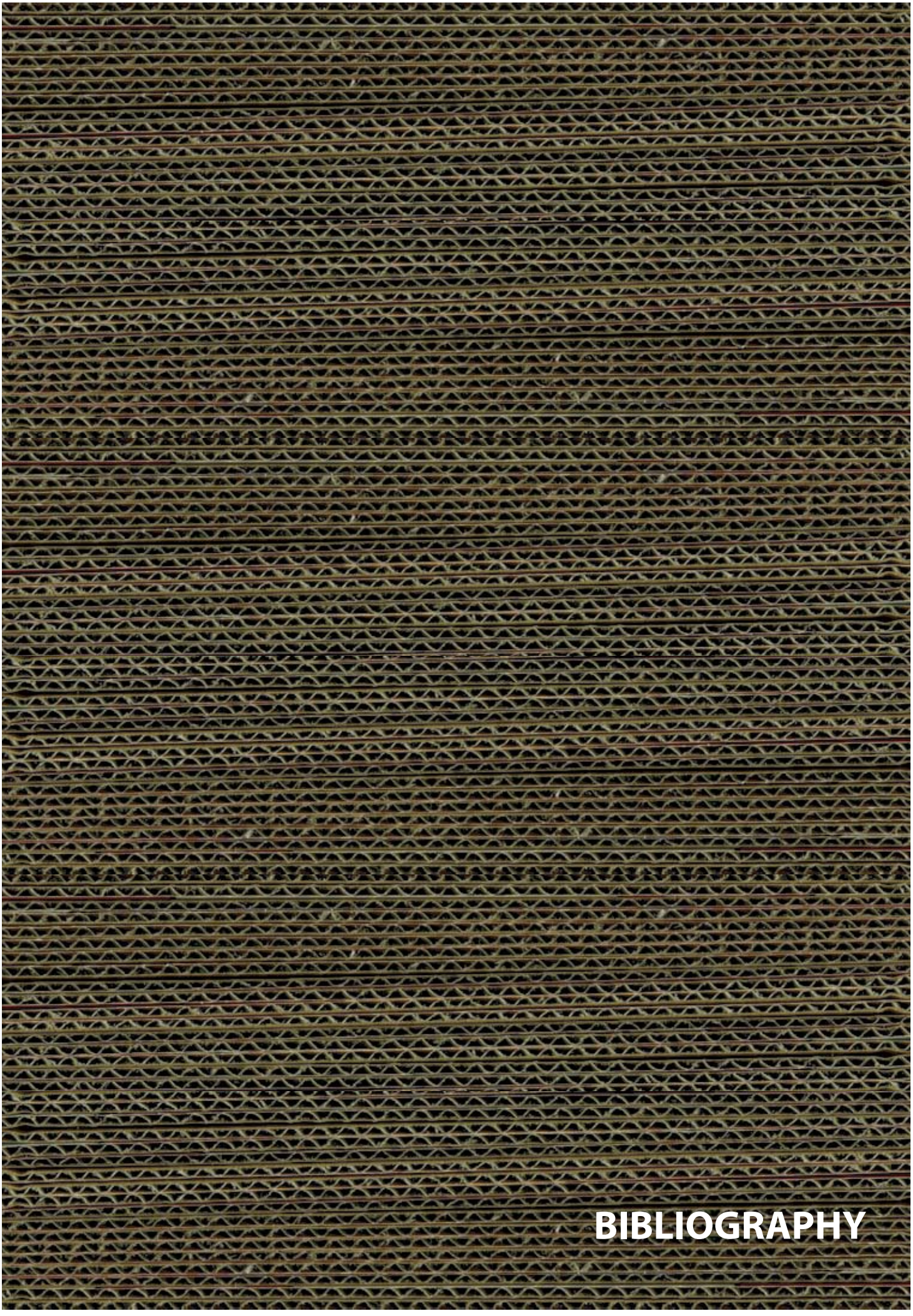


Selected animation stills from

MISSING LINKS - ENDLESS FORM







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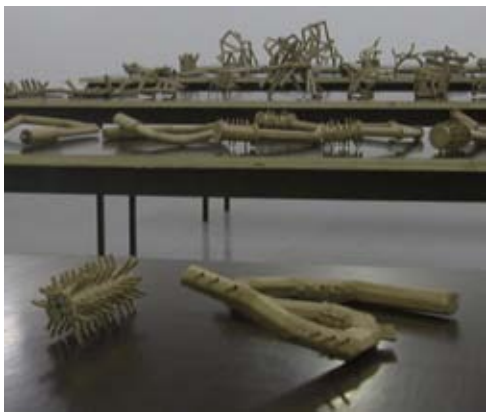

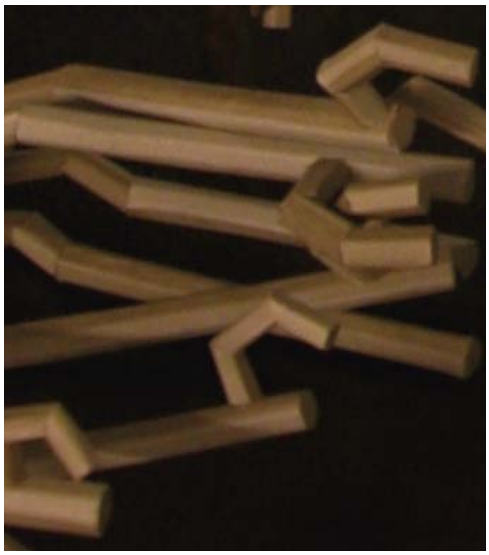

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.

Charles Darwin
The Origin of The Species